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# ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY  
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# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS.

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### ANEURYSMORRHAPHY.

TREATMENT OF POPLITEAL ANEURYSM BY THE RECONSTRUCTIVE METHOD.\*

BY JOHN FAIRBAIRN BINNIE, M.D.,

OF KANSAS CITY, MO.,

Professor of Surgery in the University of Kansas.

SINCE Matas read his classical paper on endo-aneurysmorrhaphy before the American Surgical Association in 1902, much attention has been devoted to this subject. It is not my intention to make any effort to cover the whole field of the surgery of aneurysm, but I will confine myself to a consideration of the possibility of obliterating the aneurysm and at the same time reconstructing the artery in such fashion that the circulation through it may be restored. For a clear understanding of what may possibly be attained and of what can surely not be attained, it is necessary to refresh our memories as to the common varieties of aneurysm.

1. If a small area of a pneumatic tire becomes degenerated the pressure of the air causes a local, more or less spherical, bulging at this spot (Fig. 1). If the bulging part is opened we see that it is a sac with a small opening communicating with the interior of the healthy tire (Fig. 3). The appearance of the tire and the sac in longitudinal section is

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\* Read before the Section on Surgery, New York Academy of Medicine, March 6, 1908.

shown in Fig. 2. This corresponds accurately to the ordinary sacculated aneurysm.

2. If the degenerated area of the tire includes the whole circumference of a limited section of the tire, then the tire endeavors to dilate uniformly, in a fusiform fashion, but is prevented by the felly or solid rim of the wheel (Figs. 11, 12, 13). On opening the dilatation we find it is a sac with an opening at each end. The sac is *not* a pouch of the tire; it is the tire and its whole wall is degenerated. One part of the sac wall is not evidently distended simply because the felly supports it; this gives a superficial and fallacious appearance of pouching. The condition corresponds accurately to a fusiform aneurysm which lies against and is supported by bone and can to some extent mimic a sacculated aneurysm.

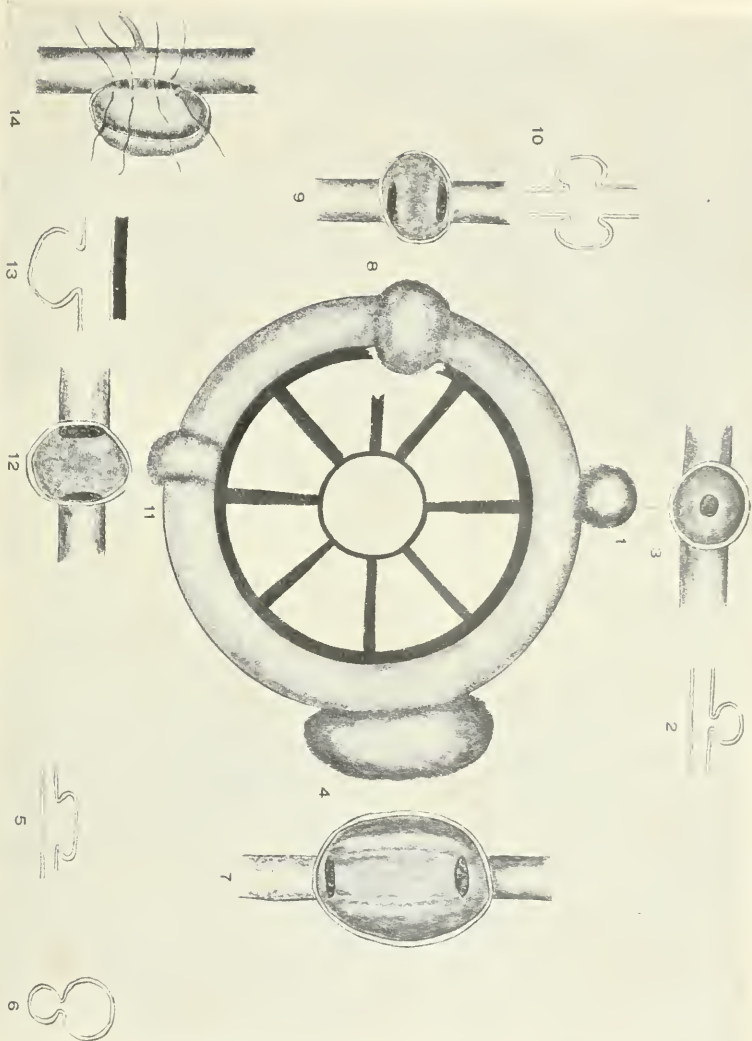
3. The degenerated area includes the whole circumference of a limited section of the tire, but the felly is absent (Figs. 8, 9, 10). A fusiform dilatation results and corresponds accurately to a fusiform aneurysm.

4. The degenerated area involves considerable of the length, but little of the width of the tire. Corresponding to this area there is bulging of the tire (Figs. 4, 5, 6, 7). If the sac is opened we see two openings, but these openings are connected one with the other by means of a distinct groove or gutter consisting of sound material. The form of defect is identical with that first mentioned except that the connection between the sac and the lumen of the tire itself is a long slit instead of a round hole. This corresponds accurately to a sacculated aneurysm, but a sacculated aneurysm which mimics and is often mistaken for a fusiform aneurysm. The illustration used by Matas when describing reconstructive endoaneurysmorrhaphy applied to fusiform aneurysms shows distinctly this type, not the fusiform type, of aneurysm.

If a fusiform aneurysm is ever the result of direct injury to the vessel without there being pre-existent disease of the wall, it must be extremely rare. To me it seems almost an impossibility.

The development of an aneurysm is generally to be re-

Fig. 1





ferred to some series of strains acting on a vessel whose strength has been diminished by pre-existing disease. This view is supported by the facts that laboring men are the usual victims and that in about 80 per cent. of the cases a history of syphilis is present. Atheroma is commonly and vaguely accused of being the predisposing cause of aneurysm but atheroma is most marked in the aged while aneurysm seems to prefer victims of from 30 to 50 years. If atheroma was the predisposing lesion we would then expect it to be most common in the aged and as atheroma is very wide-spread in its effects on the vessels one would expect multiple aneurysms to be very much more common than they are.

Pierre Delbet notes that while the popliteal artery is a favorite site of aneurysm it is not a common site of atheroma; that plaques of atheroma are rarely found near aneurysms and never in recent aneurysms; that when plaques are found in the sac, they are secondary,—the sac being an old one. He believes with Eppinger that the cause of aneurysm is mechanical injury causing rupture especially of the middle coat.

Malmsten thinks that gummatous degeneration of the middle coat of an artery is the predominant factor in the genesis of aneurysm. Sansom states that an aneurysm may be seen in an otherwise healthy aorta and quotes Sutton as writing, "I have had a sense of awe on looking into the body and seeing that, while all the other organs and tissues were so exceedingly healthy, death had been caused by so limited a disease."

Councilman regards arteriosclerosis as the most common cause of aneurysm; with Thoma, he believes that it is most common in the beginning of the arterial disease when the degeneration of the media is not compensated for by thickening of the intima and when the individual is still capable of severe and sudden muscular exertions which suddenly raise blood pressure and can cause injury to the already weakened intima. These views of Councilman seem to reconcile many conflicting notions.

From the preceding paragraphs it seems that while an

artery as a whole may be diseased and somewhat weakened, yet one limited area thereof is so much more affected either by the disease or by concomitant injury that it gives way while the rest of the vessel remains capable of discharging its functions satisfactorily. If these arguments are in accordance with fact, and for various reasons facts are hard to establish in this disease, then it is reasonable to suppose that if sufficient arterial wall is left to re-establish the arterial tube and this arterial wall, though probably diseased, is not too much degenerated, then it may be possible safely to close with suture the communication between the artery and sac. In the case of a fusiform aneurysm nothing short of excision of the diseased segment of artery and end to end anastomosis of the more or less healthy arterial stump or the implantation of a suitable segment of vein (I am only discussing reconstructive operations) could be of any conceivable value. The reconstructive operation of Matas seems to me out of the question under such circumstances. In a sacculated aneurysm provided that the opening between the vessel and the sac is not too wide, *i.e.*, provided a sufficient amount of the circumference of the vessel remains sufficiently healthy, then a reconstructive operation may give good hope of success.

I have used the method originally outlined by Matas in two cases. In the first I did not recognize at the time that I was doing a so-called reconstructive operation. I closed the single small opening into the sac with catgut and then obliterated the sac by rows of sutures. (Transactions Am. Med. Assoc., Section on Surg. and Anat., 1904.)

The second case was the following:

S. W. K., 67. Seen June 23, 1907. Perfect family history. No syphilis. Three years ago knocked down by automobile the wheels of which passed over left leg just below the knee. Much bruising. Confined to bed one week; crutches two weeks. Apparently absolute recovery.

About three weeks ago stepped into "squirrel hole" with left foot in such a manner as to cause great dorsal flexion of the

foot. At this time he felt "something give way in calf." Pain was not severe but swelling soon appeared in popliteal space. This swelling increased in size until patient went to bed a week ago.

*Examination.*—Heart normal. No distinct arteriosclerosis. Urine normal. Large pulsating tumor at popliteal space. No tibial pulse palpable.

*Diagnosis.*—Popliteal aneurysm.

June 24.—Ether. Elastic constrictor to thigh. Longitudinal incision into tumor revealed a cavity full of soft, black, non-lamellated blood clot. Cavity had no distinct walls and was size of two large fists. After the clot was removed a ruptured aneurysm as large as a medium-sized orange was found communicating with the cavity through a  $\frac{3}{4}$  in. opening about  $\frac{1}{2}$  in. from the remnants of the arterial trunk. The walls of the aneurysm were fairly healthy. On splitting the true aneurysm sac two arterial openings were found about 1 to  $1\frac{1}{2}$  inches apart. Fairly healthy arterial wall, consisting of about  $\frac{2}{3}$  the circumference of the artery, united the two openings and formed a groove on the bottom of the sac. A catheter (Fr. 15) was put into the arterial openings and the communication between the artery and sac was closed by iodized catgut sutures, the catheter being removed before the sutures were tightened. Obliteration of the sac by means of continuous catgut suture. Cigarette drain in the blood cavity first encountered. Skin wound closed. Dressings applied. Limb placed in vertical position. Constrictor removed. The condition was one of ruptured traumatic aneurysm. Owing to the impossibility of obliterating the false aneurysmal cavity, healing was slow but the aneurysm has remained cured.

In both cases reported and in a similar one I saw with Dr. W. J. Frick, the result as regards *cure* of the aneurysm, was good, but in none of these cases could it be proved that the circulation was re-established through the vessel. Judging from the experiences of Hertzler and others in arterial surgery, the mere fact that catgut, and iodized catgut at that, was used for the closure of the neck of the aneurysms ought to mean that obliteration of the vessels took place and the attempted *reconstructive* became in fact, successful *obliterative* opera-

tions. Each of these cases seemed to me suitable for attempts at reconstruction, but the technic employed outraged every one of the principles elaborated by Carrel and was foredoomed to failure.

In a third case I endeavored to utilize the principles of modern arterial surgery.

H. H. G., 40. Colored. Barber. Smallpox 6 years ago. Syphilis 15 years ago, treated for three months. Nov. 14, 1907. Fourteen weeks ago noticed pain on straightening left leg. Twelve weeks ago noticed swelling in left popliteal space which has gradually increased in size. Unable to extend knee. Pain severe enough to disturb sleep. Pain increasing. Circumference left leg at upper margin patella 16 inches as compared to 14 on sound side. Posterior tibial pulse present left side but weaker than on right. Temp. 99.8. Pulse 128. Large pulsating popliteal tumor.

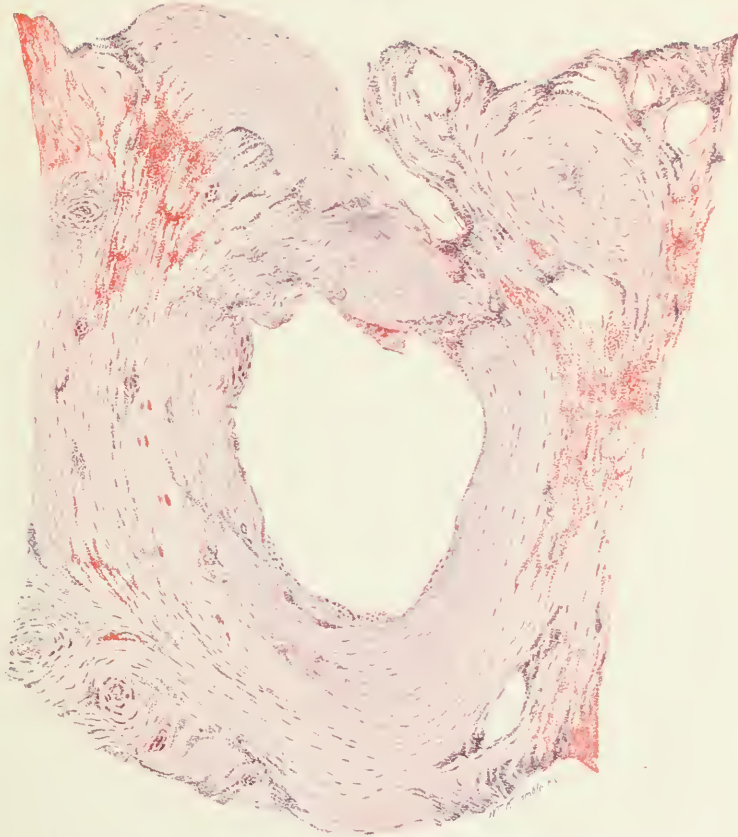
*Diagnosis.*—Popliteal aneurysm.

Nov. 15, 1907. Elastic constrictor. Longitudinal incision into tumor showed a large, irregular cavity full of clotted blood. On removing blood clots a ruptured aneurysm was found containing much fibrinated clot, which was removed. The walls of the true aneurysm sac were very ragged and friable. On the deep surface of the sac there was an oval opening about  $\frac{3}{4}$  to 1 in. in longitudinal, and  $\frac{3}{8}$  in. in transverse diameter. This opening formed a trough with three orifices (besides that one leading to the sac). Two of the orifices were the proximal and distal orifices of the popliteal artery, the third and smaller (opposite the hiatus) was evidently a branch.

The patent portion of artery was well and gently washed with salt solution and then smeared with vaseline. The hiatus was closed as in the Matas operation but vaselined No. 1. von Braun's hemp was used as suture material. Two rows of these continuous sutures were inserted. There was not enough aneurysmal sac of strength sufficient to permit suture obliteration of the sac. This was unfortunate as the obliterated sac is a great support to the line of arterial suture. It was impossible to obliterate the false aneurysm cavity. Elastic constrictor removed. No bleeding.

The deep wound or cavity was drained and the superficial

PLATE I.



Microscopical appearance of section cut through scar of repair in vessel wall.



wound closed. Dressed. Leg was elevated. The foot was warm and the posterior tibial pulse was perceptible. Owing to the fact that a sutured artery was left unsupported, passing through a non-obiterated cavity, an elastic constrictor was arranged round the thigh in such a manner that it could be tightened at a moment's notice.

Nov. 18. Dressing changed. Deep dressing were saturated with blood but were dry. Removed drain. No discharge. No pain. Tibial pulse clearly felt.

Nov. 29. Up till yesterday tibial pulse good. Yesterday being Thanksgiving day and the patient feeling well, he celebrating by shaving himself and moving about in bed freely. At night he felt considerable pain in the thigh and calf. On examination I found a pulsating swelling in the popliteal space; œdema of the leg; *no* tibial pulse; foot warm.

Nov. 30. Ligation femoral artery at apex of Scarpa's triangle. Reopened old wound and drained. Dec. 31. Has been home for some time and felt well. Wound in popliteal space almost closed. During last night sudden severe hemorrhage. Constrictor applied by patient himself. Seen by Dr. R. M. Schauffler who gave him proper emergency treatment. This morning reopened popliteal space in which there is a cavity with rigid friable walls. The tissues are so friable that local means of permanent hæmostasis are impossible. The patient is weak. Amputation lower third thigh. Recovery.

*Pathologist's report* (DR. F. J. HALL).—"The specimen consists of a pyriform mass of tissue 14 cm. by 8 cm. in diameter. From apex to base of this mass is found the popliteal artery surrounded by muscle and adipose tissue. Throughout much of the tissue are streaks of effused blood and inflammatory induration. Toward base of mass is an irregular cavity measuring 5 by 5 cm. It is lined by a ragged grayish membrane. On one side of the cavity is perceived a round opening communicating with the popliteal artery. On one edge of this opening is seen a knotted suture. At the bottom of the cavity is a ragged opening that extends through the muscle mass behind. On posterior aspect of specimen is found some clotted blood overlying a considerable area of muscle and fat tissue that is thoroughly impregnated with effused blood. Section through the artery near the place of rupture shows interior of artery slightly irregular with a definitely thickened wall and surrounded by a mass of hemorrhagic inflammatory tissue.

*Microscopic examination of section cut through scar of repair in vessel wall.*—The arterial wall throughout its entire circumference shows

great distortion and thickening of the different tunics. It is with difficulty that the various coats are distinguished. An irregularly thickened spongy tissue, poor in cells, takes the place of the intima. The lining endothelium is absent. The inner elastic membrane cannot be distinguished. The media shows as a greatly thickened tunic of hyaline connective tissue, in which the fibrillation is all but lost, the individual bundles fusing into one another leaving narrow clefts occupied by slender structureless nuclei. In places the media is penetrated obliquely by small hyaline walled vessels surrounded by round cells and a few polymorphonuclear leucocytes. In several places in the media, the bundles of fibres are separated by an amorphous granular bluish staining material that seems to be a molecular degeneration of an infiltrate similar in all respects to gummatous matter. At one point in the vessel wall is an obliquely placed pathway made as if by cutting instrument. At the point where this enters the lumen of the vessel, is a mass of fused red blood cells and degenerated fibrin threads entangling a few polymorpho- and mononuclear leucocytes. The space between the cut ends of the connective tissue bundles of the vessel walls is occupied by a mass of lumpy structureless pink-staining material, amid which are entangled polymorphonuclear leucocytes, round cells and giant cells of the foreign body type. Immediately adjacent to the walls of this space are a few *spindle-cell elements* (fibroblasts), and an *extremely few new-formed capillaries*. At no place do the fibroblasts bridge the gap. As the incision passes out of the vessel into the external coats, many polymorphonuclears are seen held in the meshes of degenerated fibrin and fused red blood cells. Many narrow clefts in the externa in the region of the wound are tightly packed with deeply staining round cells."

In this case the operative technic used differed from Carrel's in that freshly cut arterial wall was not approximated, but two endothelial lined surfaces were brought together as in Dorrance's method of arteriorrhaphy by eversion. The artery as a whole was very seriously diseased. In a weak chain, the weakest link having given way, an attempt was made to so repair it that it should no longer be weaker than the rest of the chain. The result of the operation was a failure, but a failure which came near being a success. The closure persisted for two weeks and then only about one-third of the line of union gave way. The case was most unfavorable; the arterial wall was markedly degenerated; the line of suture was absolutely unsupported by surrounding structures and lay exposed in the cavity of a false aneurysm, and yet apparently success was nearly attained. This failure encourages one to

hope that under more favorable circumstances success may be confidently expected and that perhaps in some cases of sacculated aneurysm of the abdominal aorta it may be possible to open the aneurysm sac, close the opening in the aorta, support the line of suture by obliterating the sac by means of sutures and so make the weakest point in a weak aorta as strong as the rest of the vessel.

## ANEURYSMORRHAPHY.

PERSONAL EXPERIENCE WITH THE MODERN METHOD OF TREATING ANEURYSM.\*

BY ROBERT ABBE, M.D.,

OF NEW YORK,

Surgeon to St. Luke's Hospital.

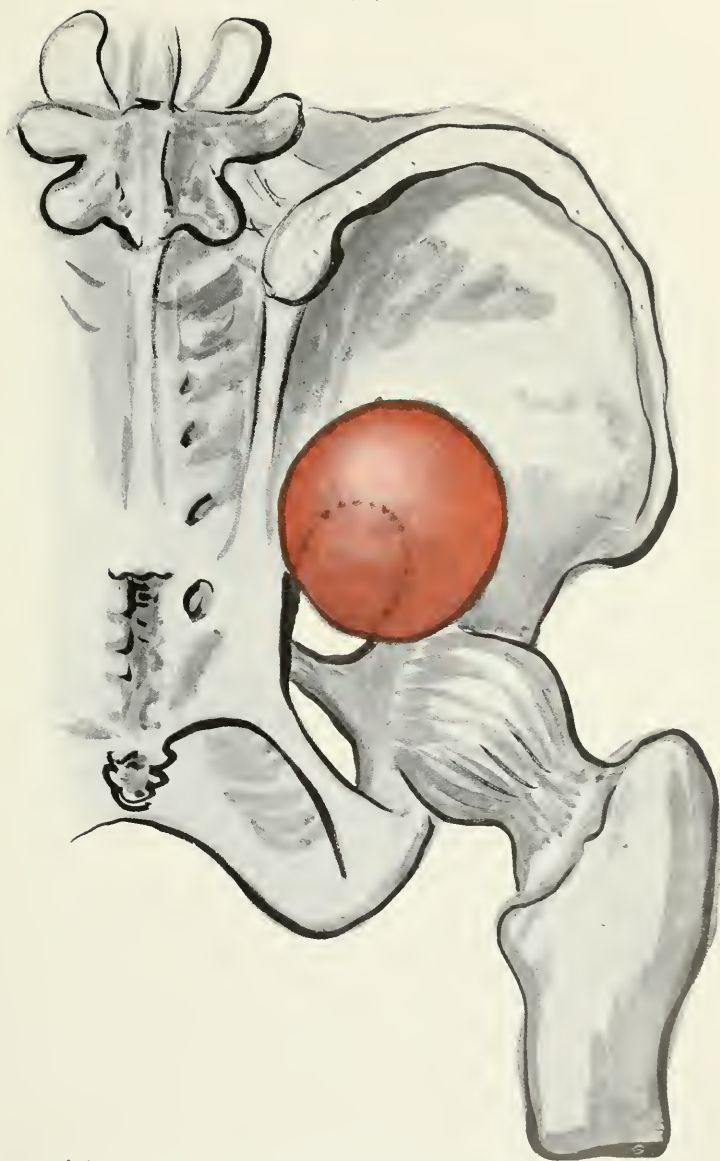
THIRTY years ago, it was considered safest to cure an aneurysm by arresting its blood current by digital compression, for a sufficient time to fill it with solid clot. It was common practice for the college professor to call for relays of volunteer medical students, to compress a femoral artery under thumb or finger pressure, for two days or more, until the aneurysm was solidly clotted. My personal experience as a student on two such occasions, gives me a lively remembrance of the tediousness of the method. Ligation by silk in those pre-Listerian days, resulted too often in fatal hemorrhage by ulceration of the vessel. Subsequently, antiseptic ligation held the field almost exclusively. One idea dominated the whole teaching of treatment, namely, the successful filling of the sac by clot, which subsequently "organized" and shrank. By organization was meant fibroid change with slow vascularization extending into the clot.

Ten years later, the theory of thickening and stiffening the resisting wall of the sac, by induced inflammation and cell proliferation was advocated, and its use put to the test in aortic, innominate and other inoperable types of aneurysm. The theory of building up and fortifying the wall from within, soon became accepted as an available method and new hope was excited. In 1886 and '87 the introduction into the sacs, of silver and steel wire, or of silk thread, was advocated, with the double purpose to induce clotting and irritate the sac lining. About the same date, puncture of the wall, by electrolytic needles, using a sharp current to excite inflammation had many

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\* Read before the Section on Surgery of the New York Academy of Medicine, March 6, 1908.

FIG. 1.



Aneurysm of the gluteal artery, filling the sciatic notch. grave neuralgia from sciatic pressure. Cured by matas operation.



advocates, and considerable success. Even Macewen's later method of scratching the lining with long hatpins, transfixing the sac, was based on the same theory.

Proliferation of the endarterial coats, was the keynote of the success of these methods. I myself had at this time two extremely interesting aneurysms of the aortic arch, into whose sacs I introduced, through a hollow needle, once, a hundred feet of sterile catgut, and again one hundred and fifty feet of fine steel piano wire, exciting its cells by electric contact for an hour (the opposite pole being at the back). Much was gained, as had been in the hands of others, the reports of which I incorporated in a paper (*Med. News.*, *Apl.* 9, 1887). Some patients so treated survived several months. Autopsy occasionally showed the wire buried in the densely over-grown aneurysmal wall. In Loreta's case, in the abdominal aorta, the sac closed tightly round six feet of silver wire, and in healing, compressed it into a small mass.

Two facts were demonstrated by these valuable contributions to our surgical knowledge of aneurysm: First, that the sac wall, if irritated, can be made the important factor in curing aneurysm; second, that where the tumor is large, the endarterial lining is considerably replaced by cellular tissue and the thinned out lining is too far gone to be available,—failure by such method is sure. In the case of Loreta's aneurysm of the abdominal aorta, there was no dissecting into outside tissues, but it had a complete endarterial lining,—hence fine plastic repair under wire excitation.

This demonstration of the value of the reparative building up of the aneurysm wall, rather than relying on clot filling alone to cure an aneurysm, prepared the surgical world to receive the new method of Dr. Matas.

I was able to employ it first in May, 1905, in a popliteal aneurysm of considerable size, which had been giving much pain from nerve pressure.

It was a simple matter to have the femoral artery compressed during the operation, and then on splitting open the sac, through a vertical skin incision, I found its walls were

eccentric to the artery, strong and continuous on the side toward the joint, but thinned out posteriorly. It was not difficult to place a fine chromicized catgut suture at the open mouth of the artery, and suture the walls together by continuous stitch from above downward, till the sac was entirely closed. One branching vessel opened into its lower half and was included in the suture. The same thread was continued into the overlying fascia and subcutaneous areola layer. A compress dressing without much pressure, gave primary union, and the case was perfectly cured without the slightest peril to the circulation of the foot. Prompt relief of pain followed.

Two things impressed me as especially gratifying: I left the work with no anxiety that I might have cut off a single superfluous drop of blood from the foot, as I might have done had I tied the femoral; and I felt that no recurrent anastomosis by the lower open mouth vessel which I sutured, could continue the dissecting action of the aneurysm. This I had once seen in a similar case after ligation.

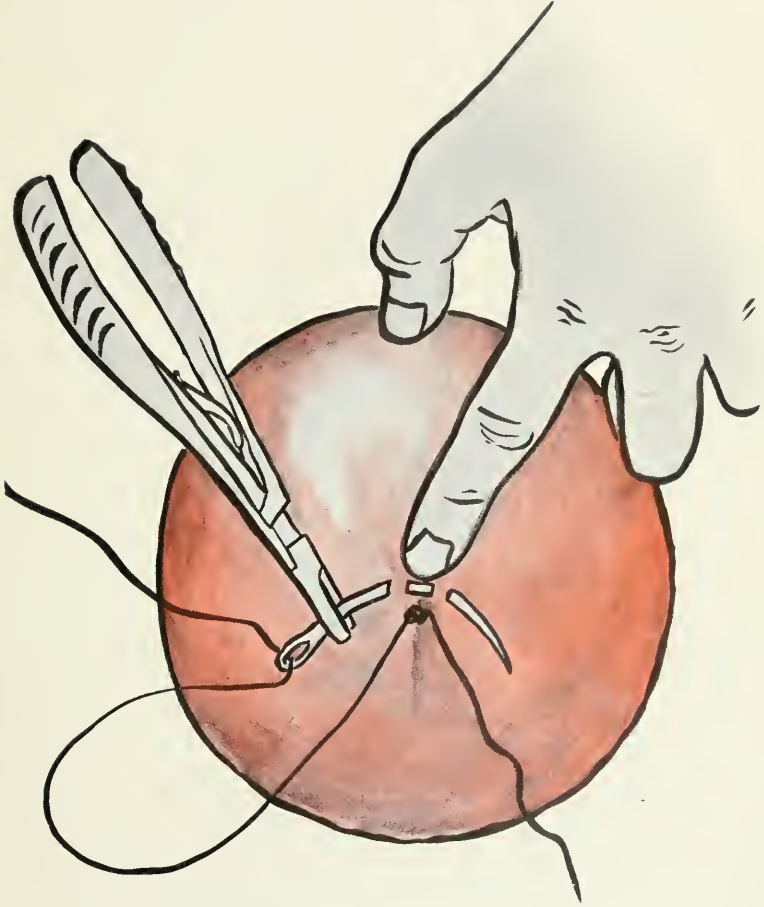
With this experiment I was prepared to apply the method to my second case, where it was peculiarly available.

A young Russian of 24 years had been developing for three months, right sciatic neuralgia with disability in walking, and some swelling of his foot. A pulsating tumor of the right gluteal region prevented his lying on that side also. The man had never had syphilis, but acknowledged gonorrhœa. His heart showed a blowing aortic murmur. Examination showed a spherical, pulsating tumor, three inches in diameter, beneath the gluteus muscle at the sciatic notch, where its pressure had caught the sciatic nerve, and held it tightly against the bone,—hence the neuralgia.

It was a particularly good case for operation by the plastic method, because ligation of the external iliac, while it would temporarily arrest the current, would allow free anastomosis and possible return; meanwhile leaving the distended sac to continue sciatic pressure.

On May 21, 1906, I opened the iliac fossa and threw a temporary silk ligature about the external iliac artery, which was held

FIG. 2.



Internal aspect of aneurysm, finger tip covering gluteal artery opening. Commencement of internal occlusive suture.



as a loop by my assistant, Dr. W. S. Schley, who drew it up against his index finger-tip, so as to avoid crushing it by tight ligation. This compression at once stopped pulsation in the tumor. I then incised over the tumor, and separated the gluteus. The sac was well distended and easily isolated. Its neck filled the uppermost corner of the sciatic notch (Fig. 1). On compression, after the pulsation had been stopped from above, it emptied, and quickly filled again. By inference, this must have been by anastomosis, as this iliac artery was quite occluded by the silk loop.

Seeing no way to keep it entirely empty; I ventured to cut it freely open, and relied on instant internal pressure to stop loss of blood. I first plugged the opening of the gluteal artery with my index finger-tip, and found no other bleeding occurred. I was then able to dry its walls and see that they were firm, with good serous lining. On releasing my finger pressure ever so little, a sharp flow of blood followed, but not in pulsating current. I now began a continuous suture of the internal wall, with fine chromicized catgut, first fixing it by a knot just above my finger-tip (Fig. 2). The next stitches were placed so as to catch in the sac wall, on both sides of my finger-tip, which I drew back as I quickly tightened them, thus sealing up the deepest part of the funnel-shaped cavity. After placing the first four deep stitches there was no bleeding, and I leisurely secured one wall against the other by continuous back and forth suturing, with the same thread. I even continued this until I had obliterated the entire sac, and closed the super structures, with no additional knot. The silk thread was removed from the iliac. The wound was bloodless. The patient made an immediate recovery.

Here we have a brilliant illustration of the reliance to be placed on the plastic union of opposing walls of an artery, held in contact, and irritated by the needle puncture and thread. This patient had no recurrence of tumor or sciatic pain up to three months after operation.

The question arises, as to how large an aneurysm we may venture to treat by this method (and how near the aorta). My own conviction is that it may be applied to any artery up to the innominate. If a firm clamp compresses the artery, we will say the subclavian, proximal to the aneurysm, the operator

can leisurely and surely occlude the sac. I can see little difference in the detail from that just narrated, and no reason for failure. I am prepared to go further and say, that if a suitable case of aortic aneurysm in the abdomen presented itself, it would be justified to combine this valuable method with one illustrated by me in 1894 (New York Medical Journal). We then showed the effect of introducing sterile glass tubes, of sizes suitable to the artery, into the lumen of divided vessels, and tying the arterial wall over each end of the tube, the latter being filled with salt solution, just before letting the current resume its course through it. I did this in a cat after cutting the abdominal aorta across, and four months afterward showed a fine healthy, and happy cat on this very platform, with the glass tube healed solidly into her aorta, the plastic exudate buried the tube, and the blood flowed for days through it, until at last the tube excited endarteritis, and occlusion resulted. Meanwhile, collateral circulation had ample time to be established. There seems to be no reason why an aortic aneurysm, below the superior mesenteric, might not be so treated. The current being arrested by strong pressure against the vertebra, the sac might be split, a tube inserted and tied in at either end; and a suture of the aneurysmal wall made tightly about the tube. It is probable that solid closure of the whole track would take place in a week, and occlusion of the aorta above and below be effected, as in my cat, by endarteritis from the presence of the tube. Meanwhile, free anastomosis would surely be established to the lower limbs. That situation is rare for aneurysm, but many cases are recorded, and the aorta has been actually ligated a number of times, in despairing hope of anastomosis, as published by Dr. Keen. The new plastic method may yet triumph.

Surgeons owe Dr. Matas high tribute for perfecting and advocating the technic of his method. The saddest side of this subject is, that, just as we have so promising and scientific a demonstration offered to the world, aneurysms seem to be going out of fashion.

## ANEURYSMORRHAPHY.

A CASE OF POPLITEAL ANEURYSM PRESENTING UNUSUAL DIFFICULTIES IN THE APPLICATION OF THE MATAS OPERATION.\*

BY JOSEPH A. BLAKE, M.D.,

OF NEW YORK,

Surgeon to Roosevelt and to St. Luke's Hospital.

W. M., a negro, forty-one years of age, was admitted to Roosevelt Hospital in April, 1905, suffering from a popliteal aneurysm. Its development had been rapid. Five weeks before admission he had noticed pain; a week later a swelling appeared which increased rapidly in size and in two weeks began to pulsate. The stiffness from the swelling and the pain became so marked that he could not walk. There was no history of lues or other etiological factors. Examination revealed a swelling the size of a duck's egg, in the right popliteal space, pushing the hamstring tendons aside. There was visible pulsation and a loud systolic bruit and thrill. There was no other evidence of endarteritis. The second aortic sound was accentuated. The lungs and abdomen were negative.

At the operation hæmostasis was secured by an Esmarch bandage, and an incision four inches long was made directly over the sac and carried down to it. The vein was found flattened over it and was retracted to one side. The sac was then opened for its full length and was found to contain a considerable amount of laminated fibrin. After its interior had been inspected, it was found that the aneurysm was a sacciform one. The communication between the artery and the sac was about one inch long and was situated less than one-half inch to the outer side of the incision in the sac, the artery, therefore, lying on the superficial aspect of the sac. This relation was wholly unsuspected until the sac was opened, there being nothing to indicate it in the appearance of the sac in the bottom of the wound.

Although under ordinary circumstances the case would have

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\* Read before the Section on Surgery of the New York Academy of Medicine, March 6, 1908.

been one admirably fitted for a restorative Matas operation, the propinquity of the incision to the orifice of the sac rendered this procedure impossible. In fact the artery being on the side of the sac toward the operator, rendered the introduction of any sutures exceedingly difficult. However, it was possible to close the communication fairly effectually with a single row of chromicized catgut sutures which, at the same time, considerably narrowed the lumen of the artery. It being impossible to make the suture line more secure, the artery was ligated on the proximal side of the aneurysm. The Esmarch bandage was then removed and the suture line was found to be efficient enough to prevent the reflux from escaping. A few catgut stitches were introduced to obliterate the cavity of the sac and the wound closed without drainage. A moulded plaster splint was applied over the dressing. The stitches were removed on the sixth day, healing occurring per primam. Three months later there was no sign of recurrence.

If one had suspected the relation of the sac to the artery, it might have been possible to have isolated it and rotated it out so as to have made the incision in it opposite its origin. Yet, isolating the sac would have defeated one of the objects for which the Matas operation was devised, namely, the conservation of the tissues and vessels about the sac, which are so apt to be injured in an enucleation. The superficial position of the parent stem made its ligation easy and although it prevented restoration of the vessel, it was analogous to the closure of the opening of the vessel into the sac by suture, as done in the Matas obliterative operation. This case, therefore, may be considered as a partially obliterative and restorative operation, in that the proximal communication with the aneurysm was closed while the continuity of the vessel below that point was restored.

It is a question whether a typical restorative or reconstructive operation is indicated for popliteal aneurysms, since the constant flexing of the joint submits the vessel to much traumatism. It would seem to me that on theoretical grounds the obliterative operation is best. That there is some ground for this opinion is shown by the fact that the only relapses

that have been reported from the Matas operation have followed reconstructive operations upon popliteal aneurysms. The restorative and reconstructive operations are, of course, only feasible in sacciform aneurysms. Even in these it seems to me that the obliterative operation is more conservative, for conditions demanding the preservation of the continuity of the vessel must be rare indeed. The possibility of thrombi, forming after the restorative and reconstructive operations, becoming detached and causing embolism beyond must be borne in mind, although, judging from the reports of cases, this accident does not seem to have happened other than after an obliterative operation. In this instance, gangrene followed an obliterative operation upon a femoral aneurysm, an embolus lodging at the bifurcation of the vessel. The only other reported instances of the occurrence of gangrene also followed the obliterative operation, but were due to injury to the vein and not to the interruption of the artery. There seems to be a general impression, based upon a faulty conception of the principles of the Matas operation, that its main purpose is the conservation of the continuity of the vessel, while in reality it is the least important feature of the technic. This impression is probably due to the natural desire to accomplish the wonderful rather than be satisfied with the more prosaic, although more effectual.

Although my experience has been gained from this one case, and although it was in a way unsatisfactory, I feel that the operation is simple. It is hardly necessary for me to say that it is based upon sound principles and is effectual, for this has already been proven by the brilliant results obtained in the hands of a number of operators, none of them reporting more than a few cases.

## THE SEROUS COAT OF BLOOD VESSELS COMPARED WITH THE PERITONEUM.\*

BY ROBERT T. MORRIS, M.D.,

OF NEW YORK,

Professor of Surgery at the New York Post-Graduate Medical School and Hospital.

It seems to me that the most important part of our new surgical work with blood vessels in general, and much of the old work with aneurysm in particular, depends upon the similarity of the serous coat of blood vessels to the peritoneum. The serous coat of blood vessels, like the peritoneum, throws out plastic lymph promptly for purposes of repair. The surfaces when irritated and brought together have a tendency to adhere, and septic processes in the serous coats of blood vessels give rise to many of the changes which occur in the peritoneum under similar circumstances. If the serous walls of an artery are merely brought together by a ligature, occlusion occurs quite as promptly and more safely than if the ligature is tied so tightly as to cut one or more coats of the artery. Torsion of blood vessels also causes such quick plastic occlusion from the serous surfaces, that arteries of the third class even may frequently be treated in this way, instead of by ligature. The methods of treatment of aneurysm by digital pressure, by the introduction of coils of wire, or by the introduction of electric needles, in the same way lead to rapid exudation of plastic lymph from the serous coats, and this exudation results in causing adhesion of opposed surfaces, or the lymph coagulates from the serous surfaces-proceed to engage the coagulates of the blood in the aneurysm in such a way as to cause rapid clot formation.

The new work in the suturing of blood vessels depends for its safety upon the prompt plastic repair of the serous coats. The new work in aneurysm brought forward by Matas gives us a striking object lesson bearing upon this kind of repair.

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\* Read before the Surgical Section of the New York Academy of Medicine, March 6, 1908.

At the same time, may we not take a warning from our experience with the peritoneum? When we first began to appreciate the promptness of repair which was carried on by the peritoneum, it was given an exaggerated value which led to mistakes. In the abdominal incision the peritoneum was sometimes drawn up between the muscular layers of the abdominal wall in such a way as to insure immediate closure of the opening; but with the danger of absorption of the products of plastic exudation in a short time, leaving the muscular and fibrous structures unrepaired, owing to the mechanical obstacle to repair which the surgeon had introduced. In our work with aneurysm, in which the construction of patent channels is contemplated, we must remember this lesson from our experience with the peritoneum. In our suturing of blood vessels generally we must remember that a weak point will be left at the site of the slightest depression of the serous coat, unless the other coats are treated in a way to fortify the weak point. There seems to be no doubt that Ziegler in his text-book on pathology was the first to liken the interior of a blood vessel to that of a serous cavity. The growth of the tunica intima after ligation he compared with the plastic inflammation of a serous membrane. Ballance and Edmunds in their "Ligation in Continuity" 1891, seem to have disputed for the first time the claim that endothelial surfaces unite with difficulty when brought in contact, and they made experiments which showed that most endothelial surfaces adhere with very little provocation. On the other hand, Meigs in his "Human Blood Vessels in Health and Disease" 1907, tends to upset what we are now building upon. He states that there is no endothelial layer which is commonly present in the human arterial system. Perhaps the presence of a fine endothelial layer, or its absence, has no necessary connection with the reparative processes carried on by the tunica intima. Practically, however, we seem to be dealing with an endothelial layer in blood vessels, which acts very much like the endothelial layer of the peritoneum. Delbet in 1906 quotes the experiment of Jensen in 1903, when a steril-

ized piece of catgut, traversing both walls and the lumen of the main carotid, was found after eighteen days to carry no trace of a clot, but that portion of the catgut which was free in the lumen of the artery was swollen at the ends and evidently covered with endothelium.

The idea that arteries can be sutured was first conceived by Lembert, about 1750, and Hallowell, under the direction of Lembert, closed a punctured wound of an artery by a winding suture, successfully. In 1772 Assmann made four experiments with winding sutures on the femoral arteries of dogs, and the animals, killed six weeks later, were found to have the arteries obliterated. There was no more vascular suturing done from that time until the development of asepsis, about 1882. Delbet impresses the point that in suture of blood vessels we must remember that everything excepting blood, in contact with the serous coats, is a foreign body, and that the endothelium resents intrusions. He states that the two conditions absolutely necessary for successful work are asepsis and integrity of endothelium. Thrombosis which forms at the site of suture is due to infection. In aseptic work, the ferment thrombi produced by leucocytes and coagulates are not formed. Small wounds in the endothelial coat, and foreign bodies, including toxins, may produce small coagula which tend to enlarge, then to contract, finally to obliterate the blood vessels. The endothelium has a strong tendency to proliferate, but a very little septic infection arrests this proliferation in blood vessels as it does in the peritoneum. The rapid multiplication of endothelium is probably able to arrest coagulation. Delbet in 1889 studied the influence of antiseptic solutions upon peritoneal endothelium and vascular endothelium, and found that the latter was more sensitive than the former. Proliferation was hindered to such an extent that antiseptic solutions were shown to actually prevent healing of arterial wounds. This observation is one of great importance for our consideration in the new work with the arteries. Petit and Jensen demonstrated the harmlessness of aseptic sutures. Etling has never seen any evidence of thrombosis or inflamma-

tion at the site of aseptic tears of the tunica intima, but he has seen proliferation of endothelium at the lower edges of wounds and necrosis at the upper edges, so that in spite of efforts at repair, slight depressions were left. Blood pressure acting upon such slight depressions would have a tendency to develop aneurysm, although Peyton in 1907 sums up the whole subject of aneurysm as a matter of the middle coat alone.

In conclusion, I wish to impress the point that in our new surgical work with blood vessels in general, and with aneurysm in particular, we are to consider the serous coat of blood vessels as acting like the peritoneum, in carrying on immediate repair. We must be even more careful about leaving depressions of the tunica intima without fortification, than we need be in leaving depressions of the peritoneum, for the reason that the blood current will take advantage of such depressions more quickly and more continuously than is done by intra-abdominal organs.

In a case which I reported previously in the *ANNALS OF SURGERY*, temporary cure of a very large popliteal aneurysm was obtained by transforming the sac into a canal similar to the original artery. Recurrence of aneurysm began later at the site of a small depression apparently, and continued to increase from that point, although the greater part of the sutured area remained strong. I mean to suture other large aneurysms,—even of the aorta, if such a case comes for treatment, but the little pit in the tunica intima is the one into which we are likely to fall, in this new sort of work.

# LIGATION OF THE LEFT COMMON ILIAC ARTERY.

WITH REPORT OF A RECENT CASE.

BY WM. J. GILLETTE, M.D.,

OF TOLEDO, O.,

Professor of Abdominal and Clinical Surgery in the Toledo Medical College,  
Surgeon to Robinwood Hospital.

So few cases of ligation of the common iliac arteries have been reported that the one here presented seems to me to be of sufficient interest to be placed on record.

Prof. Z., in April, 1905, was referred to me for examination and advice by Dr. W. A. Dickey, of Toledo, and Dr. F. M. Firmin, of Findlay, Ohio. He was 56 years of age, of American birth and had been many years a prominent educator in the State.

About seventeen months prior to examination, he had a severe fall, and a short time after noticed a small pulsating tumor in the left buttock, probably arising from the sciatic artery near its exit through the sacro-sciatic foramen. It had recently been rapidly increasing in size until the pulsation could be felt over almost the entire buttock. Aneurysm was apparently present and operation advised.

On April 22nd I operated at Robinwood Hospital. The size of the aneurysm was such that successful ligation of the artery above it and below its exit from the pelvis seemed extremely improbable. For this reason the abdomen was opened and the left internal iliac artery ligated near its division from the external.

The patient made an uneventful recovery. Pulsation ceased entirely, and the mass rapidly diminished in size. A complete and satisfactory cure was thought to have been accomplished; but seven months later pulsation was again noticed in a small enlargement arising from the former site of the trouble. Immediate operation was again advised, but was deferred for nearly three months, when the mass had increased very considerably, but had not reached anything like its former dimensions.

On April 18, 1906, at the City Hospital in Findlay, with the assistance of Drs. F. M. Firmin and H. L. Green, I dissected down to the pulsating tumor in the buttock, thinking to ligate

the artery above it; but the farther I continued the dissection, the larger the sac grew and it was found to be absolutely impossible to ligate healthy artery outside the pelvis; neither was the Matas operation feasible.

The abdomen was again opened and compression made on the external iliac, with the idea that the blood supply of the aneurysm might come from some unusual branch of that artery, inasmuch as the internal iliac had already been occluded. A deceptive cessation of pulsation in the aneurysmal sac appeared, and the artery was quickly ligated; but to our amazement on re-examination of the tumor, we found pulsation had not been affected in the least.

Nothing was now left to do but ligate the common iliac and this was accomplished with some difficulty. A silk ligature was placed around it and tied close to the bifurcation of the aorta. Pulsation in the tumor now ceased entirely and the abdomen was closed. Through the incision in the buttock first made, the sac was freely opened, a large blood clot turned out, and the collapsed walls tied off at as high a point as possible.

Within three days the leg below the knee began to show signs of gangrene which soon fully developed, and on April 24th it was amputated at about the junction of the upper and middle thirds. The flaps promptly sloughed and reamputated, on May 16th, at a point about six inches above the knee. The wound now rapidly healed as did the incision in the buttock.

When the abdomen was reopened, incision was made in the line of the old one, to which a portion of the large intestine had become cemented and unfortunately a small opening was made into it. This was closed and no trouble expected from it; but a week later, a nurse, in giving an enema, found water escaping through the abdominal incision, and an annoying fecal fistula developed. This soon closed spontaneously.

Recovery, though slow, was complete, and in September the patient resumed his arduous duties as Superintendent of the public schools of a large city.

A résumé of the literature of ligation of the common iliac artery shows that this operation has been very infrequently performed, and that the death rate following it has been and is yet, very high; also that gangrene of the leg is of frequent occurrence, and beyond the power of the surgeon to prevent.

Carl Dreist of Strassburg, in 1903, published a paper in the *Ztschr. für Chir.*, compiling all the cases found in the literature up to that time. In reporting these cases he adopted the classification of Kümmel, placing them under four heads; first, those that were performed only for the purpose of checking hemorrhages; second, to cure aneurysms of large vessels; third, to devastate vascular pulsating tumors; and fourth, to prevent bleeding during extirpation of tumors or exarticulation of the femur.

He found that fifty-nine cases had been operated prior to 1880, or in the pre-antiseptic era; and since then, until 1903, he was able to find reports of nineteen more.

In addition to the cases reported by Dreist, in a search which I had made in the Surgeon General's office at Washington, I have been able to add one more which was reported in the *British Medical Journal* in 1903, pages 77 and 78, by Arthur H. Martin, in which a private in the late Boer war received a bullet-wound in the left groin and an aneurysm of the left iliac artery developed, for which ligation of this artery was done with recovery.

A summary of the cases reported, including my own, would show that the iliac arteries have been ligated all told eighty times, with fifty-six deaths, or a death rate of 70 per cent. over all; that fifty-nine of these operations were done prior to 1880, during the pre-antiseptic era, with forty-six deaths, or a death rate of 77.97 per cent.; and that in the twenty-one operations done since 1880, presumably with aseptic precautions, there were ten deaths, which shows a reduction in the death rate to 47.64 per cent., a very decided improvement. Gangrene of the leg has occurred in the last twenty-one cases seven times, or in  $33\frac{1}{3}$  per cent. In the fifty-nine cases prior to 1880, the same number, seven, with six deaths were reported. This is probably an error; for no doubt there were many more.

Dreist says very truly that although the death rate has been lowered in later times by aseptic methods, the operation is still a dangerous procedure, and should only be employed in the presence of the gravest necessity.

## THE QUESTION OF OPERATION FOR NON-PENETRATING INTRACRANIAL TRAUMA.\*

BY JOHN A. HARTWELL, M.D.,

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NON-PENETRATING injuries of the cranial contents may be divided into four classes in their consideration from a therapeutical standpoint. First—Those in which the injury is so slight that recovery is certain without operation. Second—Those in which the severity of the injury is so great that death is inevitable in a short time. Third—Those in which the injury is of such a nature that operation is positively indicated. And fourth—Those in which the indications for and against operation are more or less evenly balanced, the border-line cases. The first and second classes need but a brief consideration. In the first are included cases of mild or moderate concussion without gross anatomical lesions. The diagnosis of this condition usually offers no especial difficulty. As a rule, the inflicting violence is not very great. The patient loses, to a greater or less extent, consciousness; the face is pale, there is vomiting, muscular relaxation, including the sphincters, and a loss of tone in the blood vessels, causing sweating and feeble rapid pulse. The reflexes are usually at first diminished, and then exaggerated. The pupils are, as a rule, dilated. The respirations are shallow and rapid. The temperature is not elevated, and may be lower than normal. The course of the condition is toward recovery, and in a short time, with rest in bed, the administration of stimulating enemata, cardiac restoratives, and external heat, a marked improvement is noted. It must be remembered that this picture of concussion may be present as a complication in any brain injury, and may mask the symptoms of a more serious lesion. The more severe cases

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\* Read at a meeting of the New York Surgical Society, Feb. 26, 1907.

of concussion belong to class four, and will be considered there.

Under the second class belong those cases in which the damage to the brain is very extensive, or implicates the centres of the vital functions in the medulla. Extensive damage (of this sort) results usually from multiple fractures with large intracranial hemorrhage and laceration of brain tissue. The latter are occasionally seen without fracture. A localized injury involving only the medulla is, fortunately, rare, for death is almost instantaneous. The patients of this class present such a varied symptomatology, and their condition is one of such extreme shock, that no accurate diagnosis can be made. Death usually ensues within a few hours, and no treatment is indicated, other than the means usually employed to combat the shock. This, however, should be done energetically and consistently, because it occasionally happens, that the brain damage is not so great as the shock indicates, and recovery is possible.

The class of cases in which operation is plainly indicated, and that class where its value is doubtful, are of especial interest. In deciding for operative interference in any case of intracranial injury, certain well founded principles have been formulated in the past, and our present knowledge in no way alters them. First—An accurate diagnosis of the pathological lesion existing must be possible. Second—The possibility of relieving this condition must be present. Third—The operative violence in accomplishing this must not be excessive. And fourth—It must be reasonably certain that complete recovery will not take place without operation.

Cerebral localization has made great advances through the work of the physiologists, neurologists and pathologists during the last decade, and accurate diagnosis is accordingly advanced. In dealing with a trauma, however, considerations arise which are not present in brain tumor and abscess, namely: those due to the general concussion and to the possibility of multiple brain injuries being present. For these reasons, the advances in localization are not of so great value in working

out the problems presented by our subject, as they are in a more circumscribed pathological lesion.

A careful analysis of all non-penetrating intracranial injuries shows that only two sub-groups can be properly made under classification three, where operation is positively indicated. The first of these is when the brain injury is due to a direct damage to the brain by a depressed fracture, and the second, the classical middle meningeal hemorrhage, or hemorrhage from a cerebral vessel directly affecting a sensorimotor area. In the first sub-group the procedure of dealing with the fracture and the underlying brain injury is well established along definite lines, and needs no elaboration at this time. Emphasis must, however, be laid on the necessity of exploring every suspected fracture of the calvarium, even though no evidence of actual brain injury is present, for such injury may exist in the absence of symptoms and late epilepsy often supervenes on such a condition.

The clinical picture in the second sub-group is usually well defined, and rarely is a diagnosis not made. The history of the injury, followed, usually though not invariably, by longer or shorter periods of concussion, then freedom from symptoms, with the later onset of compression, muscular contraction and paresis on the opposite side, are too well known to require any comment. Operative interference in all cases of these sub-groups is positively indicated. The following case of Dr. Gallaudet, by whose courtesy I include it, is an excellent illustration.

CASE I.—Admitted to Bellevue Hospital on November 27, 1907, in the service of Dr. Gallaudet, with the history of having received a fist blow over the left side of the head the day before. He was not rendered unconscious, but almost immediately became aphasic. On admission he was aphasic, and showed a right-sided paralysis of the arm and face. Operation showed a stellate fracture with extra and subdural hemorrhage, as well as hemorrhage in the brain cortex over the area indicated by the symptoms. Recovery.<sup>1</sup>

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<sup>1</sup> For a full report of this case by Dr. Gallaudet, see page 122.

The following cases, however, show the difficulties which may arise, and the caution which is needed in drawing conclusions.

CASE II.—*Trauma over left parietal region from falling timber. Subdural hemorrhage over right precentral convolution with late development of irritation and pressure symptoms. Operation with recovery.*

A man, aged 49 years, colored, was admitted to Lincoln Hospital on Feb. 27, 1906, with the following history: On Feb. 21st he was struck on the head by a large piece of timber falling from a height of one or two stories. He was knocked to the ground, was picked up unconscious and taken to a hospital in an ambulance. He regained consciousness in about twenty minutes, but was excitable and irritable. There was a large scalp wound over the left parieto-temporal region. This was sutured. He continued in his irritable and rather unmanageable condition during the next six days, without, however, manifesting any local cerebral symptoms. In addition to his irritability, he had several attacks of vomiting. He was taken home against advice. On his admission to Lincoln Hospital, six days after the injury, the following notes were made: Patient has a healed scar on the left side of his head, six inches long and curved like an operative incision. Patient seems drowsy, yet at intervals he is irritable, restless and unmanageable, trying to get out of bed. Patient does not respond to questions, and on being aroused looks at one with a vacant expression. Heart, lungs and abdomen all normal. Extremities: no change in sensations apparent. No paresis or paralysis. Reflexes: markedly increased. Control of bladder and rectum perfect. No change in pupils. Shortly after admission patient had a convulsion, which was reported by the attendant to be general in character.

During the following three days the convulsions were repeated several times, were of very short duration, and no evidence that they were at all localized could be obtained. On March 2nd these convulsions began to occur with great frequency, about every twenty minutes, for periods of an hour at a time, followed by a period of rest. They were becoming longer in duration, and the following notes on their character were then made: There was a vacant staring expression of the eyes, with a gradual conjugate deviation toward the left; after four or five seconds, there was a tonic contraction of the muscles of the left side of the face,

then a drawing of the head downward on the left shoulder, with an elevation of the latter; then tonic contractions in the arm, and then in the leg of the left side. This phase occupied about fifteen seconds, and was followed by clonic spasms of the same parts and in the same order. The whole convulsion lasted from sixty to ninety seconds, during which time the patient was totally unconscious. He then gradually regained consciousness and the contractions ceased. At this time, when he had altogether about twelve convulsions, he for the first time showed a decided left facial paralysis, and marked weakness of left arm and leg. This was on the ninth day after the injury, the first convulsion having been noted on the seventh. On the eighth day his condition had apparently improved. Operation was performed on March 2nd, nine days after the injury, and as soon as the localized character of the convulsion and the paralysis was evident. Under ether, a curved incision was made just above the right temporal ridge, about eight inches in length, and carried directly down to the skull, the flap being turned downward. The fissure of Rolando was now marked out, and a trephine opening was made over the face-centre, in ascending frontal convolution, and enlarged upward with the rongeur, to an area of about two inches in diameter. The dura showed no pulsation, and a clot could be seen beneath it. Dura was divided around the line of the bone opening, and a large organized clot was removed from the cerebral cortex. Electrodes applied to the facial centre produced a prompt contraction of the muscles of the face on the left side. No response could be obtained in either of the extremities, possibly because the nerve cells here were too much damaged, and inspection indicated that the cells for the arm were more damaged than those for the face. The opening in the skull was not extensive enough to reach the leg centre. The dura mater was closed with catgut sutures, a small rubber tissue drain put down through it, and the scalp sutured back in place. It was noted that the scalp was quite œdematous, probably due to lymphangitis following the original scalp wound.

Post-operative notes: March 4th—Recovered from anesthetic without incident. Slightly excited during first twelve hours, and then became rational, but continues rather stuporous. Can be roused and gives correct account of injury, and other details of his residence, work, etc. Still has considerable weakness of

left upper extremity, and less of the lower extremity. Is able to make coordinated movements. Slight spasticity of left lower extremity, none of upper. Left-sided facial paralysis, and left deviation of tongue. Upper branch of facial less paralyzed than lower. Examination of reflexes unsatisfactory. No oculo-motor paralysis. March 6th—Patient less rational than formerly. More stuporous. Complains of pressure on head. Very restless. Left arm can be moved only with great difficulty. Face more markedly paralyzed. Wound examined and pus found along the suture line. Considerable distension. Opened after stitches were removed. Infection all through the scalp, due to previous lymphangitis. Pus infiltrating tissues down to the dura. Dura thickened, and brain apparently well walled off by dense adhesions. Wound area opened up widely and dressed with free drainage and bichloride solution. March 9th—Wound very much cleaner. Both sides granulating well. In centre, still suppurating. Left arm can be moved more freely. March 11th—Wound granulating well. Patient more rational. Movements on left side stronger. March 13th—Patient improves slowly. Mind brighter. Movements of left side gradually returning. Can put left hand to mouth and nose with effort. Cannot hold up a single finger of his left hand. March 15th—Wound granulating well. Pulsations fair. Complains of being in bed. Left facial paralysis less marked. Can nearly hold up finger of left hand. March 27th—Wound granulating well, nearly free from pus. Mental condition practically normal. Left leg can be used nearly as well as the right. Left arm not so powerful as right. Power of coordinated movements not entirely regained. With eyes closed, fingers do not meet by several inches. Left not so strong as right. Facial paralysis still slightly present on left side of face. Left eye cannot be shut tight. Left angle of mouth can be drawn back but a very little. April 10th—Patient discharged, forty days after the operation. Wounds entirely closed. Still showed slight incoordination of left side of body, and slight left-sided facial paralysis. He walks without any dragging of the foot. Mentally, he is normal.

April 25th—Eight weeks after his operation there was absolutely no evidence of his injury remaining except the scars on his head, and the brain pulsation beneath the opening in the skull. There is no evidence of any irritability of the brain due to adher-

ent dura. The patient was again seen on February 10th, 1908. The only evidence of his trouble is found in a loss of general strength and an irritability of temper. No paralysis or convulsions have developed.

The interesting point here was the late onset of localizing symptoms. He had been under observation in two hospitals for nine days, before any evidence on which to base an accurate diagnosis was available. And yet at operation a subdural hemorrhage was found directly over the motor area, on the side opposite to the injury. A case reported by Dr. Krauss, *Amer. Journal Medical Science*, Vol. 128, is the almost exact counterpart of this.

CASE III.—*Trauma over right parietal region from falling brick. Paralysis on right side. Operation on left side. Extra and subdural hemorrhage over right motor area. Death.*

Man, age about 30 years, was admitted to Lincoln Hospital May 19, 1906, with a history of having been struck on the right side of the head by a falling brick. Patient was rendered entirely unconscious and remained so on his arrival at the hospital in the ambulance. Examination at that time showed the following conditions: Patient entirely unconscious. Cannot be aroused. Pupils equally dilated. Do not react to light. No strabismus. No facial paralysis. Hematoma on right side of head over the posterior frontal area. Suggestion of a depressed fracture of the skull, but not definitely determined. No laceration of scalp. No bleeding from ears, nose, or mouth. Spine apparently intact. Chest normal. Pulse very slow, though regular. Second sound of the heart good. Pulse shows slight increase in tension. Lungs normal. Breathing varies. At times, Cheyne-Stokes in character, at other times it became stertorous. Abdomen normal. All superficial reflexes are delayed, though present. Knee-jerks present but not exaggerated. Cremasterics delayed. All extremities moved normally though hard to elicit on account of unconscious state. Sensations delayed but present. One hour later an incision  $2\frac{1}{2}$  inches long was made on the right side of the head, through hematoma down to the skull. No fracture discovered over the parietal bone anywhere on the right side as far as felt. One hour later, patient still entirely unconscious. Color good. Pulse slow but of good volume. Slight increase in tension. Breathing more regular and deep. Pupils: left slightly contracted, reacts to light; right dilated and does not react. *Right eyelid*

*partially paralyzed with a tendency to right facial paralysis.* Irritation with pin causes no response on right side. On left side of face causes shutting of eyelids and twitching. *Right arm and leg partially paralyzed*, though not entirely so. Some response to pin. Toes moved some. Knee-jerks absent on right side. Very slight on left. Cremasteries delayed on right side. Present on left.

Three hours later. Patient entirely unconscious. Supra-orbital pressure causes facial movement on the *left side*. Only slight on *the right*. Pupils: right dilated, left contracted. Neither reacts to light. No strabismus. No nystagmus. Pin pricking on whole of left side, including face and extremities, causes active movements on that side. Right side pricking causes movements of left extremities, with evidence of sensations but feeble movements of right arm, face, and lower extremity, those of the right thigh being a little stronger than those of the leg. Right knee-jerk exaggerated. Superficial reflexes of right side about normal. Knee-jerk of left side about normal. Superficial reflexes on left exaggerated. While eliciting cremasteric reflexes, patient voided urine and was apparently conscious of the act. Pulse still slow. Respirations labored and stertorous. Five hours after the injury patient was etherized. Head cleansed on table and a curved incision was made over left temporal region about in line with the temporal ridge. Incision down through all tissues to bony skull. Flap raised intact, and bleeding vessels caught and clamped. Flap turned down and covered with hot towel. Surface of skull exposed over left motor area (previous to incision by mensuration the motor area of left hemisphere was determined and the skull marked for arm area). Skull trephined. The dura appeared dark, but seemed to pulsate. With continuous saline irrigations trephine opening was then enlarged up and down, and to both sides, exposing an area about  $1\frac{1}{2}$  inches wide and 2 inches long. Dura rather dark, but brain pulsating. Large congested vessels in the dura. Incision longitudinal in character made through the dura and enlarged with scissors. Vessels of the pia mater exposed, greatly congested. No subdural hemorrhage. Brain tissue itself rather darker than normal, and under severe pressure. About the margins of the opening, brain appears better and more normal in color. Crucial incision now made in the dura, and brain allowed to bulge out fully half an inch.

Immediately, patient's breathing, which had been labored and stertorous previously, became quieter and deeper. Pulse found now to be increased in frequency, and more nearly normal rate. Character of brain area exposed, changed when left to bulge for a time. Central area in opening has several dark spots, as if intracerebral hemorrhage had taken place. Surface about margins became nearly normal in character. Bulging seemed to relieve some of the intracranial pressure. Puncture made through pia mater, but no fluid obtained. Slight venous oozing followed. Cerebral puncture disclosed no deep hemorrhage. Flap brought back, and with dura left open the entire tissues of the scalp were sewed back in place with continuous catgut suture. Rubber tissue drains inserted, and sterile dressing applied. Patient returned to ward and put in bed with head raised. Patient passed comfortable night. Still unconscious, though not deeply so. Breathing quietly. Pulse a little rapid. Slight movement present in right arm. Left hand had to be tied to keep him from tearing off dressing. Face flushed. Urine passed involuntarily in the bed. Slept part of the night.

May 20th.—9.30 A.M. Patient seems somewhat conscious. When name is spoken at times opens one eye and appears to hear and understand. 2 P.M. Face flushed. Breathing quietly. Pulse good with less tension. General condition remarkably good. Right pupil dilated, left contracted. Both react to light, though right, very little and slowly. Motor system same as yesterday previous to operation. Left side moved normally. Right leg, thigh and toes all moved slightly, thigh the most. The only difference is in the upper extremity, which seems more paralyzed than yesterday. To stimulation, only movement of arm elicited. Forearm and hand completely paralyzed. Right eyelid and face moved more than yesterday, though still somewhat paralyzed. Sensory, same response as yesterday. Heat, cold and pain tried. Apparently not so sensitive to heat and cold on left side as to pain. Right side not distinguishable. Right knee-jerk exaggerated. Left normal. Cremasterics, right not obtained, left normal. Superficial abdominal delayed on right, exaggerated on left. Bowels have not moved as yet. Active incontinence of urine. Mental condition improved. Patient seems to know his name and resists when catheterized. When pricked with pin, seizes hand pricking him with his left hand and mutters inco-

herently. May 22nd—General condition not so good. Mentally, more deeply unconscious. Left pupil dilated and does not react. Entirely paralyzed on right side. No response to pin pricks. Right knee-jerk slightly exaggerated, but not markedly so. At times has to be catheterized, at others has active incontinence. Deep pricking on right side of body and extremities produces movements of the other side of body. Not quite as marked as when the same prick is applied to left side. Knee-jerk right side lost. Cremasteric present. Left pupil reacts. Right pupil reacts slowly. Right axillary temperature 102.2 F. Left axillary temperature 102.6 F. May 23rd—Patient responds to name, and when asked questions mutters incoherently, though he seems to hear and partly understand. Paralysis on right side total. Sensation on right side dulled. Pin pricks cause very little movement on the opposite side. Left side sensations less marked. Left pupil contracted and reacts. Right dilated, and it also responds slowly. Patient breathes rather heavily and seems comatose most of the time. Urine passed involuntarily. Bowels have moved only with enemas. Sphincter control seems perfect. Reflexes: right knee-jerk lost, left present. Cremasterics present. These findings remained unchanged until death on May 25th.

*Autopsy.*—On removing skull-cap considerable amount of extradural soft jelly-like blood clot was found over the *right motor* area and temporosphenoidal lobe. None on the left side. On opening dura an extensive clot was found covering the lower half of the right ascending frontal convolution extending forward toward the frontal lobes. Just above Sylvian fissure, in front of Rolandic area, the clot was rather firm and the brain surface showed considerable pressure damage. Over operative wound, brain seemed entirely normal. Whole left motor area was entirely free from clot or evidence of injury, either extra or intradural. A small hemorrhage was found deep in the brain at the site of one of the needle punctures. No fracture of the skull found. Examination of the medulla showed a normal crossing of the pyramids.

This case illustrates a condition not infrequently observed, namely, the brain injury on the same side as the paralysis. Three explanations are given: first—a rare condition of uncrossed pyramids; second—a counter pressure on the opposite side from the hemorrhage against the bony wall, producing local-

ized pressure there which is not felt immediately beneath the soft cushion of the blood; and third—an error in observation, that is, the voluntary paralysis exists on the side which is moved when irritated, the movement being reflex; whereas, on the non-paralyzed side, no movement takes place, because the reflexes are inhibited by the normal cerebral influence. The latter seems the more plausible, though in this case the movements appeared to be voluntary in character. After the operation, his efforts to remove the dressings certainly could not be called reflex, and they were made powerfully with the left arm—that is, on the side where the brain damage was subsequently found—so that the arm had to be tied to the bed. Whatever the explanation is, the therapeutic procedure should be to open both sides of the skull in such cases. The neglect to do so here probably cost the patient his life. The muscular reflexes, as usually elicited, it will be noted, varied from time to time, sometimes being greater on the right side, and sometimes on the left. The variations in the pupil, too, were irregular and not to be classified, though as a rule they were of the Hutchinson type described below. These curious variations in reflexes are those reported by all observers, and emphasize the fact that clinically the teaching of physiology concerning the reflexes is of little value. Their confused condition in spinal injury has been the subject of much unsatisfactory study. This case is very instructive when considered in conjunction with Case II. The injuries were very similar in their nature, but the results were quite divergent. In Case II the hemorrhage was only subdural on the side opposite to the injury, and the paralysis was contralateral to the hemorrhage and slow in developing. In Case III the hemorrhage was both extra and subdural on the side of the injury, and there was a homolateral paralysis developing early. The late development in Case II seems to have been due to a chemical destruction of nerve cells by the changes in the blood clot, while the early development in Case III was undoubtedly due to the immediate effects of the pressure.

Loeb has shown that the cerebral cortex is not excited by the ordinary chemical stimuli which affect nerve fibres. This does not preclude the possibility, however, of a stimulation due to a change in the cells themselves when subject to a condition such as that found in Case II. No recent hemorrhage was present, and the pressure per se did not seem sufficient to cause the symp-

toms observed. Some of the cells, too, seemed inexcitable to faradism, which still further points to serious damage in their structure having taken place.

*CASE IV.—History of old trauma over left side of forehead. Symptoms of late abscess over left motor area. Operation without finding lesion. Death. Autopsy showed no brain lesion, but a condition of the kidneys suggesting acute uræmia as cause of symptoms and death.*

Man, age 28, admitted to Lincoln Hospital April 6, 1907, in an unconscious state, the following history being obtained from his family. Three years previously the patient was struck on the left side of forehead. Was unconscious from the blow for over twenty minutes. Recovered in a short time with seemingly no ill effects. About six months ago patient suddenly had trouble with his speech. Was unable to speak for a time. Attack similar to "petit mal." Would be all right the next day. Since that time he has never been quite the same. Speech thick and hard to understand. After succeeding attacks he seemed to become depressed in spirit, and at times acted as if he were drunk or drugged. About two months ago he was treated at this hospital for injury to left foot, from stone falling on it, causing a bursting laceration on the sole. Wound cleaned, drained and sutured. Healed up very rapidly. At this time he was considered mentally weak. He was brought to the hospital in an ambulance yesterday, while in an unconscious condition, and having convulsions, general in character. According to his wife, who found him in this condition, he had never had any attacks of this kind before.

Examination showed the patient to be well nourished. He was entirely unconscious, lying in bed with head turned to the left; eyes also drawn to the left. Pupils equal, regular, reacting to light. Eyes oscillate slightly and at times slight incoordination is seen. There is constant twitching of right hand, particularly middle fingers. Also twitching at times of right side of face, right leg, and whole right side of body. When twitching is most marked, left leg becomes involved. The temperature ranges from 100 to 103.5. Pulse 110. Respiration 25 to 30. Leucocytes 20,000. There was no paralysis noted, though the right extremities seemed weaker than the left. The picture here given is that of a late abscess following a trauma, and the great-

est point of irritation seems to be over the motor area for the face and arm in the left hemisphere. The conjugate deviation of the eyes is away from the side on which the extremities are involved, and not toward it, as is the rule. One discrepancy is noted. After twenty-four hours' observation, operation was advised and accepted.

*Operation, April 6th.*—The motor area of left hemisphere was determined, and the skull marked for arm area. A horseshoe shaped incision was made through all the tissues down to the skull, over left motor area, flap being turned down and protected by a hot towel. Skull trephined and opening enlarged with rongeur. Dura appeared normal through opening about  $1\frac{1}{2}$  inches wide and 2 inches long. Incision made in dura exposing cerebrum, just anterior to fissure of Rolando. Brain pulsating normally, no bulging, vessels in pia seemed enlarged, but membranes about them appeared abnormal, some places being pearly white, but mostly yellow. These areas small and opaque. The exposed area of brain was then thoroughly explored with needle in search of abscess, but with no result. Dura closed with catgut sutures. Flap sewed back in place with interrupted and continuous catgut sutures. Dressing applied. April 7th—Patient still in unconscious condition. Seemingly a little brighter. Pupils equal, dilated. Some drooping of left eyelid. Slight nystagmus. Eyes still drawn to left side. Pupils react to light, but sluggishly. Marked flattening of right side of face. Right arm flaccid with some twitching of hand, but not so continuous. Left arm rigid. No reaction to sensation or pain on either side. Right leg flaccid; purpuric condition on leg extending from ankle to upper third of thigh. No reaction to pain or sensation. Knee-jerk increased. Babinski present. Left leg rigid. Knee-jerk normal. No Babinski. Cremasteric reflexes absent on right side, present on left. Abdominal reflexes active. Dermographia all over body, marked on abdomen. April 8th—Patient had a general convulsion. Twitching in hand not present. Condition worse. Rise of temperature to 103.5. Very rapid small pulse. Breathing irregular. Has to be fed by catheter through the nose, and per rectum. Urine and feces lost in bed. April 9th—During a convulsion this morning, eyes were first noticed becoming incoordinated and drawn to right side, then twitching seen on right side of face, tetanic movements rapidly increasing, then extending to fingers

of right hand and arm, next the right leg was involved, then becoming general. Attack lasted about two minutes, dying out where it began. No increase in knee-jerk on right side. No Babinski. Death sixty hours after operation, with no change in condition last noted.

*Autopsy.*—The brain exposure was found to be exactly over the face and arm area. Nothing abnormal was found on the surface, either in the dura or the brain itself. Sections showed no abnormality other than those due to the needle puncture. At the end of one of these  $1\frac{1}{2}$  inches from the surface, beneath the arm area, there was a clot about  $\frac{3}{8}$  inch in diameter. Other smaller clots were also found. This is interesting as explaining in part the greater degree of paralysis after the operation. The kidneys showed a condition of acute degeneration which the pathologist reported to be due to a toxemia of some sort. There was no evidence of any chronic lesion. The possibility of the convulsions being uræmic, cannot be excluded, though previous to operation, and following it, urine was freely excreted. It contained considerable albumin and some blood, particularly just prior to death, but this was believed to have been due to his toxic condition. All the other organs were found normal, and no additional cause of death could be determined.

It is well known that uræmia may cause one-sided convulsions simulating a brain irritation. In this case, however, the history of the old head injury, the weakness on the convulsed side and the elevated temperature, with the leucocyte increase, all seemed to justify the suspicion of brain abscess.

*CASE V.—Unconscious alcoholic patient with head contusions. Convulsions on left side. Operation and death. Autopsy showed localized cortical softening.*

Unknown man, age about 45 years, admitted to Bellevue Hospital September 27, 1906, from Harlem Hospital with a diagnosis of alcoholism. He was in coma most of the time, but soon after his admission it was noticed that he was having frequent general convulsions, one every hour or so. On Sept. 29th the convulsions became localized to the entire left side of body, each one lasting from one half to two minutes. In the intervals the left side seemed to be paralyzed. Complete examination at this time showed the man to be partially conscious, but unable to answer questions. He showed every evidence of

being markedly alcoholic. Supraorbital stimulation brought on convulsions of the left side of the body, eyes deviating to the right; pupils are equal and moderately dilated, and react normally. Pulse regular; fair force; moderate tension. Knee-jerks absent on both sides. Left upper and lower extremities paralyzed. Right extremities both moved voluntarily. No paralysis of face, but some convulsive twitching on both sides.

Examination of head shows general contusions and bruises over face and forehead. The case was considered one of probable alcoholic cerebral oedema, but the presence of contusions on the head, and the localized nature of the convulsions and paralysis, led me to operate rather against my judgment. Accordingly the motor area was exposed over the left hemisphere, and the brain found to be in a congested condition, and somewhat oedematous, but no localized process to account for the left-sided convulsions. Following the operation, the patient's condition was practically unchanged, and he died about two hours later.

*Autopsy.*—The brain was found to be markedly oedematous, with areas of circumscribed softening scattered irregularly over the cortex. This condition was especially marked in the first temporosphenoidal convolution on the right side, and in the angular convolution, both of which are situated well behind and inferior to the motor areas. Operation in this case was done on insufficient data. The element of an alcoholic cerebral oedema, with the localized softening, was given too little weight.

A summary of these four cases shows, one with distinct local hemorrhage over a motor area, giving no symptoms until the ninth day, and three with all the symptoms of a localized motor lesion, in which, at operation and autopsy, no such lesion could be demonstrated. Nothing could better illustrate the difficulties encountered in making an accurate diagnosis in these conditions, and the necessity of being cautious in deciding for operation.

There is left for our consideration the fourth group of our classification, the true border-line cases, and this constitutes one presenting even greater difficulties. A study of the manifold functions of the brain, its liability to serious injury despite its complete protection in the skull, its inaccessibility to the surgeon, and its delicate structures, reveals at once the cause of these difficulties. The cases coming under this group may be conveniently divided pathologically as follows: First—Serious con-

cussion. Second—Contusion, that is, multiple small lacerations of brain tissue and blood vessels. Third—A more extensive laceration confined to a limited area. Fourth—Hemorrhage not giving distinctly localized symptoms, that is, not causing irritation or compression over an area of known and demonstrable function. Fifth—A combination of two or more of the above. in the first sub-group, serious concussions, a careful study of the symptomatology will usually be rewarded by a correct diagnosis. There is, almost without exception, a history of an injury acting rather diffusely over the head, followed by immediate unconsciousness. Vomiting is present, but not of the projectile type seen in compression. The whole appearance is one of extreme shock, or collapse, except that the pulse, while soft and compressible to the vanishing point, is not always correspondingly accelerated. This condition lasts a varying time, and is *usually* followed by slow improvement, if the result of a pure concussion, without gross lesions. Occasionally, however, instead of recovery a new set of symptoms is ushered in. The picture then is more complex, and with the symptoms described above, there are mingled those of cerebral excitation. These are restlessness, irritability and increased reflexes. The patient resents markedly any attempt at an examination. Instead of improvement, he passes from this stage into one of deepening coma, and the slow, full high tension pulse, and slow deep respirations mark the onset of a condition of compression. This may, of course, be due to a hemorrhage, but it also develops without this when the disturbed tone of the blood and lymph vessels allows the transudation of serum to produce a brain œdema. The following case fully illustrates these points.

CASE VI.—*Diffuse head trauma. Concussion with later onset of cerebral irritation symptoms and compression. Decompression operation. Recovery.*

A boy, ten years old, was admitted to Lincoln Hospital February 4th, 1906, at 2 P.M. with the history of having fallen a distance of 20 or 30 feet, and landing on his head and shoulders. No one actually saw him fall, so that it was impossible to get accurate data on the above points. He was brought to the hospital by ambulance in a condition of considerable shock, and partial coma. He could be aroused with difficulty; surface cold and pale; temperature 99.2, pulse 120 and weak, respiration 32. There was

no paralysis. Pupils were dilated. No localizing symptoms of any sort could be made out. Examination of the head showed an extensive hematoma over vertex and left parieto-frontal region. No evidence of fracture could be made out under this hematoma. There was no bleeding from the ears, mouth or nose, nor any subconjunctival hemorrhage.

The child was put to bed, and the usual remedies for shock, including rectal irrigations and morphine, were given. In the course of an hour the shock had considerably lessened, and the coma was less deep. He continued to recover from the shock, but the coma again deepened, and the irritability on being aroused was becoming excessive. No coordinated response could be elicited in any way. He resented very markedly any manipulations, or any effort to make him answer questions. He failed to recognize his father. All the reflexes were markedly exaggerated, but no paralysis or anesthesia could be made out. His condition was diagnosed as one of severe cerebral concussion, with progressive changes in the cerebral vessels, and beginning œdema of the brain. Under ether anesthesia, two hours and a half after admission, incisions were made over the hematoma, and the skull explored. No evidence of fracture could be found. It was determined to open the skull for the purpose of exploration and decompression. Accordingly, the temporal muscle on the left side was exposed along its origin, its fascia turned back by a semilunar incision, and the fibres separated vertically, according to the method advocated by Cushing. A one-inch trephine opening was then made at a point one and one-half inches above, and one inch in front of the external auditory meatus, exposing the dura. This was seen to be dark in color, very tense and without pulsation. No extra dural hemorrhage was found. The skull was rongeué away in all directions, making an opening of about  $2\frac{1}{2}$  inches in a longitudinal by 2 inches in a vertical diameter. The same condition of the dura was present in the whole area. A small opening was then made in the dura, and the blood-tinged cerebrospinal fluid spurted out to a distance of about 3 or 4 inches, thus showing the pressure under which it existed. The dura was then cut away over the whole surface from which the bone had been removed, exposing the brain beneath. The brain did not pulsate. The small superficial blood vessels were dilated to three or four times their natural size, and the blood in them was of a dark, venous color.

There was no actual trauma of either the vessels or the brain tissue itself apparent.

In the course of three or four minutes the pulsation in the brain gradually returned; the blood vessels became much less prominent, and the blood in them became of an arterial color. Coincident with these changes, the condition of the patient's pulse and respiration was closely watched, but it could not be determined that any change took place, the pulse rate remaining from 110 to 120. The temporal muscle, which had been retracted antero-posteriorly during the manipulations in the skull and brain, was now allowed to fall together again and was tacked with three or four catgut sutures. The temporal fascia and skin were carefully sutured along the curved section with catgut, a small drain being left down to the brain tissue. A copious dry dressing was applied to the wound. The child recovered from his anesthesia without incident, and in the course of three or four hours was entirely conscious with practically no symptoms of cerebral irritation. He gave the details of his injury, and told his name and address. His convalescence was uneventful; the wound healed per primam, and the pulsation beneath the temporal covering of the brain has been present ever since. There is no tendency for any increase in the size of the cerebral protrusion, but on the other hand, a decrease. Immediately after the operation, and during the following days, it was as much as one-half to three-quarters of an inch above the skull level. It has gradually lessened, until now its maximum is only one-quarter of an inch, and palpation shows it to be less tense than it was two weeks ago. It would have been better to have made an osteoplastic flap, but no instrument for this was at hand, excepting the gouge and mallet, which, under the existing conditions, would have been exceedingly dangerous from the continued jarring necessitated. An attempt to leave the dura in situ and resuture it failed because of the great tension, and the subsequent gradual subsidence of this tension shows that a replacement of this dense membrane would have continued to an excessive intracranial compression, and defeated the very object of the operation. The uncovered brain is a "silent area" and it may be hoped that the pericranium will develop enough thickness and firmness to protect it.

The conditions which determined operation on this boy were, rapidly increasing coma and cerebral excitability, with the strong

belief by those observing him, that he was developing the very condition found, namely, cerebral œdema, due to changes in the blood vessels, which would inevitably prove fatal if not relieved. The absence of localizing symptoms left no other course than to produce a decompression of the brain, and thus combat the increasing compression due to loss of tone in the cerebral vessels.

Subsequent note, Feb. 10th, 1908.—The protrusion of the brain has entirely subsided, and given place to a depression one-half inch below the scalp, that is, to its normal level. Except for the skull opening it is entirely normal. The satisfactory result here obtained by no means warrants the conclusion that such lesions invariably produce a picture so easily interpreted. It was the apparent hopelessness of not operating, that acted as the determining factor in deciding for operation.

Cannon and Cushing have studied this condition and both come to the conclusion that an œdema of the brain may arise in this way, through osmotic forces, sufficient to give pressure symptoms by driving out the blood from the medullary centres. In this particular case, this phase had just been reached, and it was apparently rapidly increasing.

CASE VII.—*Diffuse trauma of head. Symptoms of marked cerebral irritation and compression after three hours. More marked over right precentral area. No improvement for three days. Decompressing operation over right motor area. No localized lesion of any moment. Prompt improvement and ultimate recovery.*

A woman, age 28 years, fell from a street car on Aug. 24, 1907, striking her head on the pavement. She apparently received no severe injury and walked home. When seen by the ambulance surgeon shortly after, she was quite rational and apparently not much hurt. She refused to go to the hospital. Three hours later the ambulance was again called, and she was brought to the hospital, where examination showed the following condition: Patient lies on right side with knees drawn up. Arms folded across the chest. There is an apparent condition of chilliness, and the bed clothes are drawn up beneath the chin. She assumes above attitude whenever moved. Eyes are closed, breathing natural and she appears in natural sleep unless disturbed. She resents any interference, resisting more or less violently. She moves all extremities freely. Left arm decidedly weaker than right, also left leg

weaker than right. Irritation about the head makes apparent a paralysis of lower left facial branches. Pulse 56, hypertension. Left knee-jerk increased. No ankle clonus. Superficial reflexes unsatisfactory. Left pupil reacts to light normally. Right also. Pupils equal, and normal in size. Left eye fixed in external strabismus. Right eye moves on irritation. Palpation of skull shows profuse hematoma all over calvarium, but more on right than left side. For the following three days there was no marked change in any direction, though the slight left-sided paralysis seemed to be somewhat decreased. On Aug. 27th, operation was decided upon because of the signs of continued cerebral pressure as seen in the slow pulse, the irritable condition and the tendency to coma when left undisturbed.

*Operation.*—Skin incision over right Rolandic area after fissures had been mapped out on the skull. No fractures present. Trephine opening made and enlarged with ronguers. Brain showed increased intracranial pressure, but pulsated slightly. Opening of dura showed slight trace of dark colored blood clot. Reaction with a battery showed that left face area was exposed. Dura sutured with catgut. Rubber tissue drain. Skin flap sutured with interrupted silk sutures. Dressing applied. Patient returned to bed in fair condition with head elevated.

Post-operative notes, Aug. 28th.—The general condition is about the same, but the pulse has risen to 70 and 80, whereas before it ranged from 50 to 60 as the highest. Aug. 28th—The general condition shows improvement, the irritability having almost disappeared. The subsequent course was toward uneventful recovery and by the end of the week the patient was in a normal condition, and the wound was entirely healed. Undoubtedly this case would have recovered without operation. The recovery would have, however, been slower, and there was present a very good chance of later manifestations, the "cerebrasthenia" of Bailey, developing.

A decompressing operation as practised in these two instances therefore seems justifiable in the border-line cases, where no localizing diagnosis can be made. As already pointed out, the same group of symptoms may arise from such divergent causes, and the pathological conditions present be so complex, including all the grades above enumerated under

class four, that their relief is problematical. The abdominal surgeon is often confronted with the impossibility of making a diagnosis in obscure lesions, but he has the advantage of being able to deal with whatever may be found on direct inspection of the organs. The brain surgeon cannot do this, and therefore an accurate diagnosis before operation is imperatively demanded despite the difficulties. The deductions to be drawn from these considerations are apparent. Every available point must be weighed in making a diagnosis and a prognosis.

The diagnostic data may be grouped as follows: First—those of the functional disturbance of the brain as a whole. Second—those of the actual damage of brain tissue over local areas. Third—those of the derangement of function due to lesions outside of the brain. Fourth—manifestations of injury shown in organs other than the sensorimotor system. The confusing symptoms falling under the first group are usually present to a greater or less degree, that is, concussion masks and distorts other symptomatic findings. The pupils, for example, may be equally dilated, or one may be inactive while the other may be normal. Statistics should theoretically throw some light on the location of a lesion producing such changes, but a study of the various authorities, and one's own experience, give such divergent results, that little value can be placed on them. Hutchinson has pointed out that the rule is to find the pupil on the injured side dilated, due to a paralysis of the third nerve or its connections. This is more applicable to basal hemorrhage with fracture of the base, however, or with a low hemorrhage from the middle meningeal artery. The explanation of the many exceptions is probably found in the complicating disturbance of function as a whole. The other reflexes are also of uncertain value, and for the same reason. The study of the second group, namely, diagnostic data derived from damage to brain tissue over a localized area, holds out more promise. But even here, casual observation is very deceptive, and only a most rigid analysis of each symptom can lead to any safe conclusion.

Cases II to V illustrate the difficulties encountered here. Sensori motor paralyses are practically the only guides of importance, because the interpretation of pure sensation by patients suffering from head injury is often unobtainable at all, and is always confused. Valuable diagnostic information may be obtained by the presence of symptoms due to associated injuries outside the brain. Of these, the presence of a fracture of the skull is of especial significance, and if the fracture exists on the vertex the associated injury is often easily determined by inspection at this point. On the other hand, fracture at the base of the skull gives no pathognomonic signs other than those of the fracture itself. The bleeding from the nose and ears or the escape of cerebral fluid, and the subconjunctival ecchymosis, are of no value in determining the damage to the nervous structures. Occasionally the paralysis of a cranial nerve at its exit from the skull is present, and thus the line of fracture may be determined but without additional information along the lines under consideration. Anatomical considerations may lead to the satisfactory localization of a compressing hemorrhage in such cases, and Cushing earnestly advocates a low exploration in these cases for the purpose, first, of removing what clot can be reached, and second, to give relief to compression by opening the skull. This procedure seems founded on sound principles of brain surgery, and certainly is worthy of wider application than it has had in the past. Under the fourth diagnostic grouping, that is, findings outside of the brain, there are four of value: First—that resulting from a tapping of the spinal cord. Second—a protrusion of the eyeballs. Third—the condition of the choked disc due to increased intracranial pressure. Fourth—the changes in the circulation and respiration due to interference with their medullary centres. The presence of blood in the spinal fluid is often the only diagnostic proof that the brain, or at least the dura, has suffered gross damage. This blood can have two sources, one from ventricular hemorrhage, and the other from subdural hemorrhage. Hemorrhage within the brain tissue does not give it. Fracture of the base usually does.

From this sign we may correctly infer a lesion other than severe concussion when this question is in doubt. The protrusion of the eyeball also shows increased intracranial pressure and is absent in concussion alone. The same is true of the choked disc, which is more marked on the side of greater pressure. This sign is of the utmost importance and often turns the scale in making the diagnosis of a compression being present. Cushing has shown that it is a very delicate sign and changes rapidly with the change in pressure.

The changes in the circulation and the respiration are equally important. Every operating room where brain surgery is done should be equipped with the means of accurate determination of these functions. The rate and force of the pulse are most important guides. A slow rate with marked variations during short intervals is significant of various stimulation with a tending toward paralysis of that centre. Many observers have found the change in blood pressure to be in direct relation to the change in intracranial pressure, but Cushing was the first in this country to emphasize that the rise in the former was a conservative act to keep up the circulation through the compressed centres. He reports a case where the blood pressure rose above 300 mm. of mercury, with a prompt fall when the intracranial pressure was released.

Eyster has worked out the changes in respiration. He showed that the arrhythmic respiration is due to an alternate anæmia and vascularization of the centre with the failure or success of the blood pressure to keep up with the intracranial pressure. He also showed that the irritability of the respiratory centre is lost from anæmia sooner than the other centres. A rising blood pressure, with arrhythmic respirations, therefore betokens the last stage of compression as given by Kocher. Hence, a close watch on these functions is most important for diagnosis and prognosis.

From the above outline of the complicated conditions found in brain trauma, one must conclude that it is among the most difficult pathological conditions the surgeon is called on to treat. But few words are needed to consider the opera-

tive procedure to be followed, once operation has been decided upon. Practically all parts of the skull, except the base and the lower occipital region, may now be opened by means of the osteoplastic flap. It is outside the scope of the present paper to discuss the technique and the details of this method in its manifold applications. It may, however, be said that the use of the trephine and the rongeur has largely been discarded for one form or another of the electrically run burr and saw, and that with the latter, very large areas of the brain may be exposed with the minimum of shock and damage to the skull. We may even indulge in the hope that the future will see still further improvements in these implements, to such an extent that the exploratory surgery of the brain may be more rational and less hap-hazard than it has been in the past. It is safe to say, that along these lines lies the development of a technique which will yield results far more favorable than any heretofore seen.

The seven cases here reported have been selected as illustrations of groups three and four of the original classification, adapted for the therapeutical consideration of intracranial lesions. Case I is a typical example of the definitely localized lesion, giving almost unmistakable symptoms. Case II shows a similar lesion, but with somewhat modified symptoms. Cases III, IV and V illustrate the sources of error where the clinical picture simulates a definitely localized lesion, but where no such lesion exists. Cases VI and VII were selected as examples of the fourth group or the border-line cases. In neither could a localized lesion be diagnosed, nor was one found at operation. Yet the general picture seemed to justify something being done to relieve cerebral irritation and pressure. The decompressing operation fulfilled these indications, and proved of value in both cases.

A critical analysis of the subject as illustrated in the seven cases warrants the following conclusions: First—In but rare cases, namely, those of isolated injury affecting the sensorimotor area, can a positive focal diagnosis be made. Second—All grades of brain injury may be found in different

parts of the same brain. Third—A general concussion may be followed by secondary changes in the circulation which, if not relieved, produce pressure and death. Fourth—A pure decompressing operation is indicated in two conditions: (*a*) for the relief of pressure due to inaccessible hemorrhage, and (*b*) to relieve the pressure arising from traumatic œdema of the brain. Fifth—Operation done without a very definite object in view, which object is based on careful diagnosis, is apt to be more harmful than helpful. Sixth—the whole subject is fraught with manifold difficulties and the brain surgeon should strive to become a practical neurologist in organic lesions.

## SPLENECTOMY.

REPORT OF SIX CASES, TOGETHER WITH A STATISTICAL SUMMARY OF ALL THE  
REPORTED OPERATIONS UP TO THE YEAR 1908.\*

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SPLENECTOMY, or the operation of removal of the spleen, may be indicated either because of pathological changes or injuries and wounds affecting that organ.

The physiology of the spleen presents many difficult problems for solution, but the classic experiments of Bardeleben, in 1841, showed that the spleen might be removed in healthy animals and be followed by no serious loss to the animal economy. The knowledge of this fact soon led to the performance of this operation in the case of human beings who presented evidence of disease or injury of the spleen.

The close relationship existing between the spleen and the blood-forming organs would lead one to suppose that its extirpation would be followed by pronounced alterations in the blood and lymphatic glands. It has been found that slight changes do occur but of an apparently insignificant character. Vulpius, who first made this feature the subject of experimental study, concludes as follows:

1. Extirpation of the spleen produces a transitory decrease in the number of red, and an increase in the number of white, corpuscles.
2. The thyroid gland cannot vicariously assume the function of the spleen.
3. The lymphatic glands and the bone marrow show an increased blood-forming activity after removal of the spleen.
4. The regeneration of the blood, after loss of blood, is

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probably less rapid in individuals in whom splenectomy has been performed.

It has been observed that some patients complain of pain in the bones after operation which has been attributed to increased medullary activity. In some few cases the thyroid gland has apparently hypertrophied, associated with symptoms of increased thyroid function. It has been suggested,—and experimental work to some extent corroborates this,—that an animal deprived of its spleen becomes more liable to infection by any pyogenic bacteria.

Extirpation of the spleen in human beings has been done for various conditions by a number of operators and we may conclude that splenectomy is a justifiable operation in certain cases. The operation, however, is a serious one and is attended with a high mortality. The chief inherent dangers are hemorrhage and shock, but there are many additional factors which have to be considered, such as the size of the tumor, the presence of adhesions, and other concomitant conditions. A correct knowledge of the disease process is most essential, and this has to do particularly with the question whether the lesion in the spleen is a primary affection, or a part of a more generalized process.

In order to speak with some degree of understanding on these points I have summarized the contents of an exhaustive monograph by Bessel-Hagen, in which all the recorded cases of splenectomy prior to 1900 are tabulated, and to these I have added an analysis of all the subsequent operations to the first of January, 1908. In this way I have collected in all 708 cases of splenectomy, including six cases of my own. The mortality in the whole series is 27.4 per cent., while that of the 8 years from 1900 to 1907, inclusive, is 18.5 per cent. The exact value to be placed on a statistical inquiry of the kind I have undertaken is difficult to estimate. The most noticeable thing is that a very large proportion of these 708 cases are reports of single cases by different operators. This fact has a bearing in two directions: in the first place it may be supposed that only successful cases are reported, while on

the other hand one's skill in performing an operation is largely dependent upon one's experience with it. With these appreciations of the possible fallacy in the deductions I will proceed to discuss the different lesions of the spleen that may, or may not, be treated by splenectomy, and the results of the operation up to the present time.

Bessel-Hagen,<sup>26</sup> in 1900, compiled 360 cases of splenectomy, exclusive of cases of partial splenectomy. Of these, 222 cases recovered and 138 were fatal, a mortality of 38.3 per cent. In his tabulation, however, he includes only 335 cases with 212 recoveries and 123 deaths, as he chose to omit certain cases in which he believes the value of splenectomy was biased by co-existing conditions. In the accompanying table I have attempted to include all the recorded operations of splenectomy up to January 1, 1908, but have been able to find only 353 cases reported prior to 1900.

*Idiopathic Hypertrophy of the Spleen.*—Chronic tumor of the spleen, in certain instances, may be justly attributed to one of several causes, to be found either in a primary condition of the spleen, or as a part of a constitutional dyscrasia. Quite apart from these factors, however, not a few cases of chronic splenic enlargement exist in which the clinical history and all the concomitant conditions throw absolutely no light on the origin of the tumor. Nor are the pathologists prepared to classify these enlarged spleens except under the general term of chronic indurative splenitis. It seems most probable, however, that the inception of the process is to be sought in some past infectious disease. Not a few cases are undoubtedly due to a latent malarial infection, as splenomegaly is very common in individuals who reside in or emigrate to malarial regions, who give no history of chills and fever. Other possible causes are to be sought in chronic infectious diseases, such as congenital and acquired syphilis, rickets, scrofulosis, scurvy, etc., and as a sequel to acute hyperplastic splenitis from various causes. Is it not possible that some general infections may occur in which the spleen may bear the brunt of the attack without other general manifestations? One well recognized

## SPLENECTOMY. STATISTICAL SUMMARY.

Disease or Lesion.	Bessel-Hagen to 1900.			Johnston, 1900-1908.			Total to 1908.		
	Cases.	Re-covered.	Died.	Cases.	Re-covered.	Died.	Cases.	Re-covered.	Died.
Idiopathic hypertrophy .....	33	20	13	41	33	8	74	53	21
Idiopathic hypertrophy, ectopic spleen.....	45	40	5	15	14	1	60	54	6
Idiopathic hypertrophy, twisted pedicle.....	16	8	8	11	11	0	27	19	8
Malarial hypertrophy .....	88	58	30	61	53	8	149	111	38
Malarial hypertrophy, ectopic spleen.....	26	25	1	14	14	0	40	39	1
Malarial hypertrophy, twisted pedicle.....	5	3	2	7	7	0	12	10	2
Splenic anaemia .....	17	12	5	44	37	7	61	49	12
Cysts, hydatid.....	15	11	4	8	8	0	23	19	4
Cysts, non-parasitic.....	7	7	0	12	12	0	19	19	0
Leukæmia .....	42	4	38	7	2	5	49	6	43
Tuberculosis of spleen.....	4	3	1	6	5	1	10	8	2
Sarcoma of spleen .....	9	6	3	3	3	0	12	9	3
Abscess of spleen .....	7	7	0	2	1	1	9	8	1
Miscellaneous affections .....	2	1	1	11	10	1	13	11	2
Wounds and injuries.....	37	20	17	113	79	34	150	99	51
Totals .....	353	225	128	355	289	66	708	514	194
Per cent.....		63.7	36.3		81.5	18.5		72.6	27.4

cause is found in all conditions of congestion or stasis, such as an obliterative phlebitis of the splenic vein, and particularly chronic occlusion of the portal vein with associated cirrhosis of the liver.

The indications for the removal of the idiopathically enlarged spleen are not at all absolute. It is principally justified as a prophylactic measure, as an otherwise trivial traumatism may seriously jeopardize the patient's life by the susceptibility of the enlarged spleen to rupture. The mortality depends directly upon two factors: the size of the spleen, and the skill and experience of the operator.

Prior to 1890 splenectomy was performed for idiopathic hypertrophy 18 times with 7 recoveries and 11 deaths; from 1890 to 1900, 15 cases were treated by splenectomy with 13 recoveries and 2 deaths; from 1900 to 1908 I have collected 41 splenectomies with 33 recoveries and 8 deaths (see bibliography). This gives a total of 74 splenectomies with a mortality of 28.3 per cent.

*Ectopic Spleen with Idiopathic Hypertrophy.*—By far the most common cause of displaced, or wandering, spleen is an enlargement of that organ which induces a relaxation of its suspensory apparatus. In rare instances an ectopic spleen may be a congenital anomaly, as in a case cited by Moynihan in which a boy twelve years old had a spleen so mobile that it would lie in the left iliac fossa. The only other condition in which a spleen of normal size is found displaced is in connection with a general visceroptosis, as in Glenard's disease.

The indications for splenectomy in cases of ectopic hypertrophied spleen are usually definite. A patient with a large floating spleen is always in jeopardy from the possible occurrence of torsion of the pedicle. In not a few cases distinct subjective symptoms are found to be due to a displaced spleen, as it may exert pressure on, or become attached to, various organs in the abdominal cavity. A rather frequent situation is in the pelvis, where it may become adherent to the uterus, as in one of my cases, so as to simulate a subserous fibroid.

In some cases intestinal obstruction has been caused by the pressure of a wandering spleen.

The statistics of splenectomy for ectopic hypertrophied spleen show 17 operations prior to 1890 with 14 recoveries and 3 deaths; from 1890 to 1900, 28 splenectomies were done with 26 recoveries and 2 deaths. Since 1900 I have been able to find reports of only 14 cases with 13 recoveries and 1 death, as follows: Bland-Sutton<sup>27</sup>; Bryson<sup>30</sup>; Haeckel<sup>36</sup>; Lucy<sup>149</sup>; Schon<sup>217</sup>; K. Schwarz<sup>218</sup>; Silvestri<sup>223</sup>; Ashby,<sup>9</sup> large ectopic spleen complicated by typhoid fever; Llobet,<sup>147</sup> displaced hypertrophic spleen with primary carcinoma of pedicle; Tridondani,<sup>247</sup> very large ectopic spleen in a pregnant woman, delivery followed by splenectomy; Power,<sup>191</sup> large ectopic spleen due to a blow received 3½ years prior to operation; and three instances of pelvic displacement of spleen for which splenectomy was done by Cestan,<sup>49</sup> Peterson,<sup>184</sup> and Sokoloff.<sup>228</sup> To these I add one successful case of my own, in which the moderately enlarged spleen was firmly adherent to the fundus of the uterus. We thus have in all a record of 60 splenectomies for idiopathically enlarged wandering spleen, with 54 recoveries and 6 deaths, a mortality of 10 per cent.

*Ectopic Hypertrophied Spleen with Twisted Pedicle.*—As has already been said torsion of the pedicle is an accident that may occur in any case of wandering spleen. This may take place slowly so as to cause a gradual enlargement of the organ. In other cases the twist occurs suddenly and gives rise to most acute symptoms similar to those caused by the twisting of the pedicle of an ovarian cyst. It is usually possible in these cases to make out the tense and tender spleen, but in other instances operation has been performed for supposed intestinal perforation or strangulation.

Splenectomy is an operation of necessity in this condition, and the results of the cases that I have been able to find since 1900 are surprisingly good,—11 cases without a death. Prior to 1890 splenectomy for wandering spleen with twisted pedicle was done 5 times with only 1 recovery and 4 deaths, and from

1890 to 1900, 11 times with 7 recoveries and 4 deaths. The 11 additional cases which I have collected include one case each by Chandelux<sup>52</sup>; Cocran<sup>54</sup>; Hunter<sup>111</sup>; Steinbrueck<sup>233</sup>; Ullmann<sup>250</sup>; one case by Childe<sup>53</sup> complicated by a large sub-capsular hemorrhage; one case by Wallace<sup>254</sup> in a girl 12 years old; two cases in which the spleen lay on the right side of the uterus by Edge,<sup>72</sup> and by Webster<sup>260</sup> and one case by Vincent and Cabanes,<sup>253</sup> in which the spleen lay in the right iliac fossa.

*Malarial Hypertrophy of the Spleen.*—Malarial fever is a well-recognized cause of chronic splenic tumor. The "ague cake" occurs in individuals who are either repeatedly exposed to infection, or in those who are insufficiently treated. Such patients develop a more or less pronounced cachexia and for this reason splenectomy has been repeatedly performed in the mistaken idea (Jonnesco) that the spleen continues to be a habitat for the malarial parasites.

The chief indications which call for the removal of the malarial spleen are its increased size, increased mobility, its consequent tendency to rupture, and the danger of acute torsion of the pedicle. Spontaneous rupture is not infrequent in the Tropics, as the organ is easily lacerated by minor grades of traumatism that would not seriously affect a healthy spleen. The chief factors in producing mortality appear to be the large size of the tumor, and the presence of marked anæmia and cachexia.

In the period before 1890 splenectomy for enlarged malarial spleen was done 24 times with 9 recoveries and 15 deaths; and during the period 1890 to 1900, 64 times with 49 recoveries and 15 deaths. Since 1900 I have been able to collect 58 splenectomies by 31 operators, with 50 recoveries and 8 deaths (see bibliography), to which I add 3 successful cases of my own making 61 splenectomies with 53 recoveries and 8 deaths, a mortality of 13.1 per cent.

*Ectopic Malarial Spleen.*—The same indications for operation apply here as in the case of the idiopathically enlarged wandering spleen. Reports of the cases of splenectomy

in this condition would seem to indicate that the operation is performed at a more favorable period in the patient's illness as the mortality is exceedingly low. Prior to 1890, 11 cases are reported with no deaths, and from 1890 to 1900, 15 cases with 14 recoveries and 1 death. Since 1900 I have collected 14 additional cases without a death. Of these, 8 are reported by R. Schwarz,<sup>210</sup> and one each by Bargellini,<sup>16</sup> Carini,<sup>42</sup> Kelley,<sup>128</sup> Nuñez,<sup>174</sup> Potherat,<sup>190</sup> and Sakharov.<sup>212</sup>

*Ectopic Malarial Spleen with Twisted Pedicle.*—As has already been said in speaking of idiopathically enlarged spleens, torsion of the pedicle is an absolute indication for operation and removal of the spleen. Prior to 1890 this was done in two cases with 1 recovery and 1 death, and from 1890 to 1900, 3 times with 2 recoveries and 1 death. Since 1900 I have collected 7 cases without a death; 2 cases reported by R. Schwarz,<sup>219</sup> and one each by Bennett,<sup>21</sup> Coen,<sup>55</sup> Montanari,<sup>165</sup> Pozzi,<sup>194</sup> and Vignard.<sup>252</sup>

*Splenic Anæmia—Banti's Disease.*—Under the term splenic anæmia are grouped certain cases of splenic enlargement associated with anæmia. There is no history of malarial fever and the subsequent course of the disease differs from that of chronic malaria with enlarged spleen. Banti, in 1894, called attention to the frequent development of cirrhosis of the liver as the disease progresses, and the term Banti's disease is really applicable to those cases only which show the characteristic signs as he described them, viz., anæmia, splenomegaly, and hepatic cirrhosis with ascites. In splenic anæmia there is no general glandular enlargement, which serves to distinguish it from Hodgkin's disease with splenic involvement. It is differentiated at once from leukæmia by the blood picture. The usual findings in splenic anæmia are a diminution in the red cells to an average of 2,500,000 to 3,000,000 per c.mm. with a relatively greater decrease in the proportion of hæmoglobin, so as to produce the picture of a very severe chlorotic anæmia. The leucocyte count is characteristically low, usually ranging from 2000 to 3000 per c.mm. The leucocytic formula departs but slightly from the normal, although there

may be a slight increase in the relative proportion of the mononuclear elements. Abnormal blood cells,—myelocytes, nucleated red cells, etc.,—do not appear in the circulating blood.

The etiology of Banti's disease is absolutely unknown, and much careful study has failed to show whether the anæmia is secondary to some condition in the spleen or whether both the anæmia and splenic enlargement are dependent on some primary condition. As the usual course of the disease is gradually downward it has been hoped that the patient may be cured by removing the spleen. In two carefully studied cases operated upon by Harvey Cushing and J. C. Warren in 1898 and 1900 the patients are reported well and strong after 8 years and 6½ years respectively.

Prior to 1900 there are reports of 17 splenectomies in splenic anæmia with 12 recoveries and 5 deaths. These cases are cited in a paper by Torrance<sup>245</sup> who records one successful case of his own in 1907 and collects 18 other cases in which splenectomy was done between 1900 and 1907 with 14 recoveries and 4 deaths. These 18 cases were reported or operated upon by Harris and Herzog, Warren, Jaffe, Tscherniachowski, Cushing, Mayo (2 cases), Halsted, Bevan, Gordon, Jonas, Clarke, Laspeyres, Hart, Koenig, Harris, Armstrong, and Carr. I have been able to find 25 additional cases, reported since 1900 and not mentioned in Torrance's article, with 22 recoveries and 3 deaths, viz.: Bérard<sup>22</sup>; Bucco<sup>40</sup>; Caro<sup>45</sup>; Carstens<sup>47</sup>; Davis<sup>62</sup>; del Castillo Ruiz<sup>48</sup>; Flammer<sup>79</sup>; Gangitano<sup>86</sup>; Latarget<sup>137</sup>; Legnani<sup>141</sup>; Levison<sup>143</sup>; Martinelli<sup>152</sup>; Polosson and Violet<sup>188</sup>; Quénu and Duval<sup>195</sup>; Rieppi, 2 cases<sup>204</sup>; Roger, 2 cases<sup>207</sup>; Stirling, 2 cases<sup>234</sup>; Tansini, 2 cases<sup>238, 239, 240</sup>; Thiel<sup>241</sup>; Thienhaus<sup>242</sup>; and Umber.<sup>249</sup> In 4 of these cases, those of Bucco, Gangitano, and the two of Tansini, the patients were in the so-called third stage of Banti's disease, and Talma's operation was done in the attempt to control the ascites. Three of these cases recovered and 1 died.

We thus have in all, up to the present writing, reports of

61 cases of splenic anæmia, or Banti's disease, treated by splenectomy with 49 recoveries and 12 deaths, a mortality of 19.5 per cent.

*Cysts of the Spleen.*—Three kinds of cysts have been found in the spleen: (1) non-parasitic cysts (serous cysts, blood cysts, and lymph cysts); (2) hydatid cysts; and (3) dermoid cysts.

There is only one reported instance of dermoid cyst of the spleen. This was reported by Andral in 1829, and was said to contain fatty matter like tallow, with hairs scattered throughout.

Hydatid cysts are the most common form of cysts of the spleen, but are only found in those countries in which hydatid disease occurs. These cysts may attain large size and are most commonly treated by incision and drainage. In other instances splenectomy has been done. Prior to 1890 there are records of 5 splenectomies with 2 recoveries and 3 deaths; from 1890 to 1900, 10 splenectomies with 9 recoveries and 1 death. Since 1900 I have found reports of 8 splenectomies with no deaths, viz., Carnabel <sup>44</sup>; Delore <sup>63</sup>; von Herczel <sup>105</sup>; Jordan <sup>125</sup>; Latarget <sup>137</sup>; Slavchev <sup>227</sup>; Tricomi <sup>246</sup>; and Giannettasio.<sup>90</sup>

Non-parasitic cysts may be unilocular or multilocular. The most common kind is the blood cyst, which results from hemorrhage either into the substance of the spleen or just beneath the capsule. A history of trauma is obtained in many cases, while in other instances the cyst probably results from a partial rupture of the spleen during the course of some acute infection, such as typhoid fever. In not a few of the recorded cases the cyst has been found in distinctly hypertrophied spleens, which, as has already been mentioned, are especially liable to injury. It is questionable whether some of these cases should really be classified as blood cysts because the condition, as described, appears to be simply a subcapsular hæmatoma. Blood cysts of long standing usually show a distinct thick capsule, and are found to contain shreds of fibrin and granular detritus.

Serous cysts are in all probability hemorrhagic in origin, and, as Moynihan says, the solid constituents of the blood are no doubt deposited laminally upon the wall of the cyst, the fluid contents becoming thereby clearer. The operative procedure in cases of serous cysts will depend on conditions as found upon opening the abdomen. Simple puncture and the withdrawal of the fluid is not only obsolete but dangerous. If the cyst is of such size that most of the spleen tissue is destroyed, splenectomy is the operation of choice, provided there are not too many dense adhesions about the organ. If, as in some reported cases, *e.g.*, Powers' case,<sup>192</sup> splenectomy would be either impossible or extremely hazardous, then it becomes necessary to drain the cyst, after suturing it to the abdominal wall. Occasionally the cyst can be enucleated, as in a recent case of mine, in which a cyst the size of a goose egg was shelled out from the under surface of the spleen and the raw surface of the spleen closed by two sutures threaded on blunt liver needles.

Prior to 1890 splenectomy was done 4 times for non-parasitic cysts without a death; from 1890 to 1900, 3 times with no mortality. Powers<sup>192</sup> writing in 1906, has collected six cases of non-parasitic cysts reported since 1900 in which splenectomy was performed with no deaths, *viz.*, cases by Michailowsky, Routier, Dalinger, Jordan, Monnier, and Heinricius. In addition to these I have collected 6 more cases of splenectomy for this condition, in all of which recovery ensued, *viz.*, Bacelli<sup>13</sup>; Bryan<sup>38</sup>; Gerard<sup>89</sup>; Israel<sup>112</sup>; Leonte<sup>142</sup>; and McMurtry.<sup>158</sup> This gives a total of 19 splenectomies for non-parasitic cysts of the spleen with 19 recoveries and no deaths.

*Leukæmia.*—The removal of the spleen in splenomyelogenous leukæmia is very definitely contraindicated. In the early period of splenic surgery, splenectomy was repeatedly performed in the hope of eradicating the disease. In 1894, Vulpinus and Ceci collected 28 cases of splenectomy in leukæmia with 25 deaths immediately after the operation. Of the 3 cases that survived the operation one lived 13 days, another

8 months, while the third is reported as having been cured (Franzolini's case).

The total number of cases of leukæmia that were treated by splenectomy up to 1900 number 42. Of these, 4 are reported to have recovered and 38 died. Since 1900 I have found 6 additional cases, viz., Blanquinque<sup>28</sup>; Cetnarowski<sup>50</sup>; Lindner<sup>146</sup>; McGraw<sup>156</sup>; Piquand<sup>185</sup>; and Warren.<sup>257</sup> Four of these cases died very promptly after operation, while 2 cases—those of Lindner and Warren—survived. Warren's case lived about four years while the late result in Lindner's case is not known. To these I add one case of my own, in which the patient died 5 days after operation. A post-mortem examination was not obtained, and I was not able to determine the exact cause of the fatal termination as there were no evidences of either hemorrhage or peritonitis. This makes a total of 49 splenectomies in myelogenous leukæmia with 6 recoveries and 43 deaths, a mortality of 87.7 per cent.

From these results it is obvious that splenectomy is unjustifiable in leukæmia. Hemorrhage and shock are the chief factors in the mortality of this operation. In addition, our present conception of the bone marrow changes in this disease would seem to demonstrate the futility of splenectomy to stay the progress of the malady.

*Tuberculosis of the Spleen.*—Tuberculosis of the spleen does not occur as a primary affection, but nevertheless several interesting cases are on record in which a tuberculous spleen has been removed with subsequent entire recovery. These cases all presented splenic tumors and in one of them, at least, the diagnosis of tuberculous spleen was entertained because of coincident signs in the lungs. It may be said, however, that it is impossible to make a diagnosis of tuberculosis of the spleen and the condition can therefore never be treated as such.

Prior to 1890 there is a report of only 1 case of splenectomy for tuberculosis, and this resulted fatally (Burke's case). From 1890 to 1900 there are reports of 3 cases by Bland-Sutton, Lannelongue and Vitrac, and Marriott. These 3 cases all recovered, and Marriott's case, operated upon in 1891, was reported alive and well in 1906 (Moynihan). Since 1900,

I have found 6 cases of splenectomy for tuberculosis of the spleen, with 5 recoveries and 1 death. These cases were reported by Bayer,<sup>19</sup> Carle,<sup>43</sup> Cominotti,<sup>58</sup> Delore,<sup>64</sup> Franke,<sup>82</sup> and Grillo.<sup>93</sup> The case of Quénu and Baudet (1898) was not a typical splenectomy, as only a part of the spleen was removed and the lower pole drawn into the peritoneal wound and drained; suppuration continued for 4 months, and tubercle bacilli were found in the discharge. Bayer's paper has record of 9 of these cases, including that of Quénu and Baudet. Franke's case recovered from the operation but died 26 days later after leaving the hospital against his orders.

*Sarcoma of the Spleen.*—An excellent résumé of the subject of sarcoma of the spleen is to be found in the paper by Jepson and Albert<sup>116</sup> in which are collected all the cases up to and through 1904, including their own case in which splenectomy was done. Since that time I have found only one instance of splenectomy for sarcoma of the spleen, and that is the case reported by Willy Meyer in February, 1906.<sup>161</sup> This was a round-celled sarcoma and apparently not primary, as there were evidences of further metastases in the abdomen. This patient recovered from the operation and was in fair health 2 months later.

Eleven cases of splenectomy for sarcoma of the spleen are collected by Jepson and Albert. Of these 8 recovered and 3 died. One patient (Fritch-Ashe) lived 6½ years and then died of a cardiac affection. Jepson's patient was in good health 10 months after the operation. Three of the 8 cases are known to have died from recurrence of the growth.

Although the spleen seems to possess a relative immunity to secondary involvement by new growths, yet secondary sarcoma is undoubtedly more common than a primary growth. It is quite possible, however, that a sarcoma may originate in either the capsule and trabeculæ, lymphoid tissue, or endothelial cells, giving rise respectively to fibrosarcoma, lymphosarcoma, and endothelial sarcoma (Jepson). Except for the firm, solid, and usually irregular tumor, there is nothing characteristic in the symptoms, or in the blood picture, of sarcoma of the spleen.

Carcinoma of the spleen has never been recorded in any case which will bear investigation (Moynihan).

*Abscess of the Spleen.*—Abscess of the spleen is a distinctly rare condition, and is always secondary to an infective lesion either in the course of the blood stream or in immediate contiguity to the spleen. The most common cause is an infected embolus which gives rise to a septic infarct. This may occur in the course of an acute infectious disease, or follow some local suppurative lesion, especially in the portal area, such as appendicitis, pyosalpinx, etc.

Surgical treatment is always indicated in abscess of the spleen. Incision and drainage is the operation of choice, especially if the abscess is pointing, or dense adhesions are found about the spleen. In a few cases splenectomy has been done, 3 times prior to 1890, and 4 times between 1890 and 1900. All 7 of these cases recovered. Since 1900 I have found reports of 2 splenectomies for abscess with 1 recovery and 1 death, viz., Eberhart,<sup>71</sup> streptococcus infection, necrosis and abscess of spleen, recovery from operation, died 3 months later from pyæmia; and Karewski,<sup>127</sup> traumatic, necrosed spleen with subphrenic abscess, recovery.

*Miscellaneous Affections of the Spleen.*—Five splenectomies, with 4 recoveries and 1 death, have been performed since 1900 for "pseudoleukæmia." Two of these cases, DeRenzi<sup>67</sup> and Salvia,<sup>213</sup> were instances of infantile splenic pseudoleukæmia, with recoveries in each. Rochard's<sup>205</sup> case was probably one of splenic anæmia; Cetnarowski's<sup>50</sup> probably a malarial hypertrophy, while the exact nature of Erbkam's<sup>75</sup> case is not clear.

Wolff,<sup>264</sup> in 1906, reports the successful removal of the spleen in a case of infantile splenic anæmia.

Two splenectomies have been done since 1900 for benign growths, viz.: von Burckhardt<sup>41</sup> removed the spleen together with a growth involving the splenic ligament which proved to be a myxofibrolipoma; and Noguchi<sup>172</sup> extirpated the spleen together with a very large peritoneal lipoma. Both patients recovered.

Tietze<sup>243</sup> performed a successful splenectomy on a patient who had an echinococcus cyst of the spleen opened 3 years previously. The spleen was removed in order to cure a persistent sinus.

Winckler<sup>263</sup> reports a case of aneurism of the splenic artery in which he did a splenectomy. The patient recovered.

My sixth case of splenectomy may be tabulated in this group. The patient had been operated upon three years previously for an abscess of the spleen, the organ being fastened to the abdominal wall, incised and drained. She came to me with a good-sized ventral hernia in which was found a moderately large incarcerated spleen. The spleen, together with a large portion of adherent omentum, was removed, and the hernia repaired. In addition, complete hysterectomy was performed for carcinoma of the body of the uterus. The patient made a good recovery, and was reported to be in good health 2 years later.

Prior to 1900 there are records of 2 cases of benign growth of the spleen treated by splenectomy, with 1 recovery and 1 death.

#### WOUNDS AND INJURIES OF THE SPLEEN.

*Rupture of the Spleen.*—Subcutaneous rupture of the spleen is not a very rare accident. The normal spleen is only apt to be damaged by crushing injuries, but an enlarged spleen is readily torn by blows, not a few cases being due to kicks from a horse, and by falls. It is surprising how trivial an injury may cause a laceration of a hypertrophied spleen. Rupture of the spleen is particularly fatal because of the very extensive hemorrhage that almost always ensues. Immediate operation is imperative and it is usually found necessary to remove the spleen. Berger,<sup>24</sup> in 1902, collected 67 cases of ruptured spleen treated by splenectomy with 38 recoveries and 29 deaths.

*Penetrating Wounds.*—These are caused either by gunshot or stab wounds. The spleen is very rarely the only organ injured and the prognosis depends very largely upon the extent of the traumatism. The indications are for immediate opera-

tion, but the exact method to be followed in treating the wounded spleen can only be determined after the abdomen is opened. In some cases the splenic wound can be closed by suture, or the wound may be cauterized and tamponed. If the injury is multiple, or the rent large, splenectomy is the operation of choice. Berger's statistics (*loc. cit.*) give 6 cases of gun-shot wound treated by splenectomy with 2 recoveries and 4 deaths, and 7 cases of stab wounds in which the spleen was extirpated with 5 recoveries and 2 deaths.

Grouping together all traumatic lesions of the spleen there are reported up to 1900, 37 cases with 20 recoveries and 17 deaths. Since 1900 I have collected 113 cases (see bibliography) with 79 recoveries and 34 deaths. Of these 113 cases, 11 were gun-shot wounds with 8 recoveries and 3 deaths, viz.: Brennflech<sup>86</sup>; Carr<sup>46</sup>; Freund<sup>83</sup>; Graf,<sup>92</sup> 2 cases; Hartmann<sup>101</sup>; Hotchkiss<sup>109</sup>; Lebreton<sup>140</sup>; Longo<sup>148</sup>; Noetzel<sup>171</sup> and Penkert<sup>182</sup>; and six were stab wounds, viz.: Bernhard<sup>25</sup>; Ciechowski<sup>51</sup>; Demons<sup>65</sup>; Korn<sup>133</sup>; Krjenkow<sup>134</sup>; and Moses.<sup>166</sup>

We thus have reported in all, up to 1908, 150 cases of splenectomy for injuries and wounds of the spleen with 99 recoveries and 51 deaths, a mortality of 34 per cent.

#### SUMMARY.

As shown in the preceding table, there are herewith collected and tabulated 708 operations of splenectomy with 514 recoveries and 194 deaths, a mortality of 27.4 per cent.

In the period from 1900 to 1908 there are records of 355 splenectomies with 289 recoveries and 66 deaths, a mortality of 18.5 per cent. If the instances of removal of the spleen for traumatic affections of that organ be excluded there remain 242 splenectomies with 210 recoveries and 32 deaths, a mortality of 13.2 per cent. The well-recognized contraindication to operation in leukæmia may furthermore serve to exclude the seven cases in this series, which leaves a total of 235 splenectomies for diseases of the spleen with 208 recoveries and 27 deaths, a mortality of 11.5 per cent.

## SUBCUTANEOUS RUPTURE OF THE SPLEEN.\*

REPORT OF CASES WITH REMARKS.

BY GEORGE G. ROSS, M.D.,

OF PHILADELPHIA,

Assistant Surgeon German Hospital; Surgeon Germantown Hospital.

CASE I.—Robert S. Age 8. History of having fallen 8 feet down a cellar way, striking on left side of abdomen in left hypochondriac region. Accident November 3, 1907.

The first urination after the accident showed evidence of blood. He did not vomit; no marked evidence of shock; bowels moved normally. The next two succeeding days he was not so well and when I saw him two days later he presented the following symptoms:

Expression anxious, indicating some severe abdominal lesion. Some meteorism, but no vomiting. Temperature 102; pulse 20; respiration rapid and shallow. Lips and mucous membrane pale. Rigidity of left rectus muscle; tenderness most marked over splenic area. Complained of pain in left upper abdomen. The kidneys and bowels had acted normally and showed no evidence of blood. The degree of traumatism and its application to the splenic area, followed by the evidence above related, makes the diagnosis of contusion of the spleen, slow hemorrhage and a low grade, more or less localized, peritonitis, most reasonable. He also had a contusion of the left kidney as evidenced by the one hemorrhage. The boy had a slow but satisfactory recovery without operation.

CASE II.—Jacob H. Age 21. Painter. Was admitted to the German Hospital on the afternoon of September 28, 1907, having been referred by Dr. Klemm.

Patient's previous history of no importance or bearing on present condition.

Dr. Klemm kindly furnished the notes of the accident and the condition immediately following:

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\* Read before the Philadelphia Academy of Surgery, March 2, 1908.

"Jacob H. came to my office stating that two hours before he had fallen from bay window on a fence, striking on his upper abdomen. He soon recovered sufficiently to walk to his home, a distance of ten squares, then to my office another six squares and back to his home. He was pale, not able to stand fully erect; his pulse was 96; temperature normal; he referred his pain to the epigastrium, radiating toward the left side and the back. I advised him to go to the German Hospital for observation, to which his mother objected, then I ordered him to bed and to let me know if he got worse. The next day I found him, with abdomen distended, pulse 136, temperature 100, more pale and willing to go to the hospital at once."

On admission he was very pale, expression anxious. Temperature 100; pulse 148; respiration 26. Abdomen showed no ecchymosis, bruise, cut or evidence of traumatism. Lungs clear. Heart action rapid. No murmurs. Pulse rapid, weak and running. Abdomen moderately distended; general rigidity and marked tenderness. Complained of severe abdominal pain, most intense in the left hypochondrium. Hæmoglobin 48 per cent., leucocytes 20,000.

Operation on admission, 24 hours after the injury. Abdomen was opened through right rectus muscle with line of umbilicus as central point. A large amount of very dark unclotted blood escaped. A rapid survey of small and large intestine and their mesenteries, also of the liver, proved them to be intact. As the examination approached the spleen it was noticed that the blood was clotted and an examination discovered a rent in the spleen. The patient by this time was practically pulseless. Intravenous salt solution was started—a total of 2000 c.c. being given. Another incision through the abdominal wall over the spleen and three pieces of gauze were packed around the organ. A stab wound over the pubis was made for the insertion of a glass drainage-tube; the original wound was closed, excepting at the lower angle, where one piece of gauze was placed for drainage. The abdomen was not washed out. The patient made a slow recovery. On the twentieth day the temperature shot up to 104 and the pulse to 138 without a known cause, and stayed up until the thirty-fifth day, when it again reached normal. The leucocyte count at this time was 9700. Widal negative.

Subcutaneous injuries of the spleen vary from simple contusion to complete pulpification, the extent of the injury being governed by the amount and direction of the applied force and the condition of the organ. An abnormal spleen either enlarged or unduly friable will be more readily and more severely injured by minor degrees of traumatism. That the normal spleen is liable to severe injury is proven by the number of cases on record. At the height of its functional activity, the spleen is engorged with blood and is at this time more liable to injury. This condition occurs some hours after digestion. The two cases herewith reported illustrate rupture in two degrees of severity, in normal or presumably normal organs. Both were in males.

In Berger's collection, 300 cases were in men and 60 in women.

Subcutaneous injuries are more common than through open wounds. Edler's 160 cases show 51.8 per cent. as subcutaneous to 48 per cent. from gun shot and stab wounds.

Berger, *Archiv für Klin. Chirurgie*, 1902, vol. 68, pp. 768-817, gives a review of all cases up to 1902, from which the following facts have been deduced:

Frequency of rupture of the spleen compared with same injury to the other solid viscera due to traumatism he gives as follows: rupture of spleen, 20 per cent.; rupture of kidney, 22 per cent.; rupture of liver, 37.5 per cent.

Contusion of the spleen regarded as an authentic diagnosis, is in many cases hard to diagnose from rupture. The symptoms are pain and tenderness in region of the spleen, enlargement of the organ, fever, shock without evidence of hemorrhage.

*Age of Cases.*—Report of German cases: age from 0 to 10, 38 cases; 11 to 20, 33 cases; 21 to 30, 42 cases; 31 to 40, 32 cases; 41 to 50, 15 cases; 51 to 60, 15 cases; over 60, 9 cases. Report of English cases: age from 1 to 10, 11 cases; 11 to 20, 18 cases; 21 to 30, 15 cases; 31 to 40, 15 cases; 41 to 50, 6 cases; 51 to 60, 11 cases; over 60, 11 cases.

NOTE.—One case in a new-born infant, which was dropped on floor in precipitate labor.

*Pathology.*—Somewhat less than half of the ruptures affected a diseased spleen, in most cases malarial. It was especially common also during acute infections with splenic enlargement.

Of 132 pathological ruptured spleens: 93 were malarial, 15 only enlarged, no cause stated, 5 in typhoid, 1 in typhus, 1 in pneumonia, 3 in leukæmia, 1 in hereditary syphilis and alcoholism with liver cirrhosis, 9 in pregnancy, 1 in tuberculosis, 1 in other diseases.

*Spontaneous Rupture.*—Referred to by Berger. He gives over 30 examples, some with slight trauma, as bending or in labor. He reports one case in a man lying absolutely still.

*Prognosis of Ruptured Spleen.*—*Unoperated:* of 220 cases, 17 recovered—mortality, 92.3 per cent. *Operative results:* splenectomy, 67 cases, 38 recovered, 29 died—mortality, 56.7 per cent.; splenorrhaphy, 2 cases, 1 recovered, 1 died—mortality, 50 per cent.; tamponade, 6 cases, 5 recovered 1 died—mortality, 83.3 per cent.

In the above splenectomies 13 had complicating injuries, of which 9 died. In two of the recovered ones the complications were very slight.

#### LATER REPORTS OF RUPTURE OF SPLEEN.

1. BEAUMONT. Trans. Clin. Soc. London, 1902-3, xxvi, 261. Reports case of man hit by wagon tongue; spleen was ruptured. Operated. Splenectomy. Developed a left pleurisy and empyema. Had enlarged lymphatics one month after operation. No pathology of spleen.

2. FREUND. St. Louis Med. Cour., 1906, xxiv, 135-137. Reports one case of splenectomy for rupture with recovery. Operation within 24 hours. Noted leucocytosis of 9000 on admission, 18,000 on third day.

3. KIRCHNER. Ibid. Mentions 5 or 6 cases with 3 or 4 recoveries. No exact data.

4. BREWSTER. Boston M. and S. Journ., 1904, cl, 211. Reports a case of rupture of the spleen on a female of 6. Operated evening of the second day, with diagnosis of probable rupture of intestines. Wound in spleen packed, a drain was brought out by counter opening in flank.

5. SIMPSON. Lancet London, 1906, II, 364. Case of splenectomy for ruptured spleen. Operated in 5¾ hours.

6. NOETZEL. W. Beitr. z. klin. Chirurgie, 1906, xlviii, 309. Reports

five cases of splenectomy for rupture. Two recovered. One operated in 24 hours. One on third day. Of the three that died (no pathological report), 1 died apparently of shock, 1 of rupture of liver and heart complicating splenic condition, 1 of rupture of intestine (not found at operation). He calls attention to need of examination for associated lesions of viscera when doubtful.

7. FRANK. Munch. med. Wchnschr., 1906, liii, 189. Reports two cases of splenectomy for rupture. One operated within 24 hours and one on second day. The latter worked 2 days after accident—had subcapsular hemorrhage which broke second day and necessitated operation. Complicated by pneumonia and pleuritis. No pathological report.

8. FONTOYNONT. Bull. et Mem. Soc. de Chir. de Paris, 1905, us. xxxi. Reports a case of splenectomy for rupture in a woman of Madagascar, who had malaria and syphilis. Operated in 2 hours. Spleen removed as was also an injured portion of tail of pancreas. Clamps left on vessels. Spleen free of blood weighed 500 grams. It was hypertrophied and malarial.

9. SCHLUETHER. R. E. J. Missouri Med. Ass., 1905-6, 11, 23-26. Reports splenectomy in boy of 14, for rupture. Spleen entirely broken in half. Operated in 18 hours. Bleeding had spontaneously ceased. He notes hypertrophy of lymphatics in second week after operation.

10. ANORAY. Bull. et Mem. Soc. de Chir. de Paris, 1904, xxx, 900-911. Reports two cases of splenectomy for rupture, with recovery. He advises resection of ribs to expose the field of operation. He refers to several other cases and to 3 cases of spontaneous cure.

11. SHERWOOD. Brooklyn Med. Journ., 1906, xx, 62. Reports case of rupture of spleen. Operation in 3 or 4 hours. Hemorrhage all back of peritoneum and no free blood in peritoneal cavity. Spleen and clot left undisturbed and wound closed. Patient recovered.

12. DAVYS. Indian Med. Mag. Calcutta, 1904, xxxix, 219. Reports spontaneous rupture of spleen in native while lying down. No accident. Died in  $\frac{1}{2}$  hour. Postmortem: Spleen has rent in anterior angle; is soft and enlarged to double its size. No pathological report.

13. THURSTON. Ibid. p. 379. Reports operation for peritonitis. Ruptured spleen. Spleen not enlarged. The blood had become encysted, the breaking of which caused the peritonitis. No free blood in abdominal cavity.

The evidence upon which a diagnosis can be established is the history of traumatism to the upper abdomen and especially when applied to the left side; shock, pain, tenderness over the spleen, rigidity of the recti muscles, more marked of the left; later signs of hemorrhage and meteorism. The abdominal wall rarely shows the evidence of force, although it be sufficient to rupture any one or several of the abdominal organs. The absence of ecchymosis or bruising should not mislead one.

As we see these cases in the hospital the impression one receives is that the patient has a serious hurt and urgently requires operation, and it is my opinion that the time spent in making a fine differential diagnosis would be better spent in opening the abdomen on the evidence of a ruptured viscus and repairing the condition or conditions found.

If the diagnosis of injury to the spleen can be established an incision through the left rectus muscle offers the best route for handling the conditions. Unfortunately the signs of hemorrhage into the peritoneal cavity and the meteorism so often obscure the symptoms that we must make a compromise incision, that through the right rectus muscle being the best. The umbilicus should be on a line with the middle of the incision. One can readily and rapidly enlarge upward and downward. Injuries to other organs will be more readily seen and recognized by this route.

## GANGRENE OF THE GALL BLADDER.

BY ANDREW STEWART LOBINGIER, M.D.,

OF LOS ANGELES, CAL.

THIS comparatively rare condition has been mentioned by all of the prominent writers on the diseases of the gall bladder, but there have been singularly few cases reported in literature. In conversation with a number of surgeons here and abroad, whose wide experience in the pathology of gall stone disease is a matter of international note, I have been surprised at the few instances of true gangrene of the gall bladder which have fallen under their observation. This fact and certain unusual features in the pathology, would seem to make the case here reported one of some scientific interest.

CASE.—F. J., Teuton, age 55, married. He was first seen February 26, 1906, by Dr. Paul Adams, by whose courtesy I was permitted to see the patient. The family history was negative. Until recently he had been a resident of Brooklyn, N. Y. Up to five years ago he had been a hard drinker, chiefly whiskey. On Oct. 15th, Nov. 15th and Nov. 29th, 1905, he had suffered severe attacks of pain in the region of the gall bladder. These attacks, which were supposed to be gall stone colic, developed and disappeared very suddenly and left the patient prostrated. Jaundice, more or less persistent, had been present for more than three years. Early in the history of the case he was said to have sugar in the urine and an excess of urea.

When first called Dr. Adams found the patient suffering severe pain in the region of the gall bladder. These pains radiated downward, as well as upward toward the right scapula. The liver was somewhat enlarged extending an inch below the costal border. There was marked tenderness on light pressure over the gall bladder. The heart showed a moderate systolic murmur. There was a well marked jaundice, and bile and a trace of albumen were found in the urine. At this time the temperature was normal and the pulse 90, but the patient felt sure the pain he was suffering was more severe than in any previous attack. I

was called in by Dr. Adams on March 1st. The patient was a large plethoric subject with jaundiced skin and conjunctivæ. His temperature was then 102.4° F. and the pulse 118 and he had had several rigors. He complained of a severe pain in the right hypochondrium which extended through to the back. The right rectus was rigid and there was a dense mass in the region of the gall bladder, which was only slightly tender on firm pressure. The diagnosis was suppurative cholecystitis with localized peritonitis, and immediate operation was advised.

The operation was at the California Hospital on March 2nd. The gall bladder, which was several times the normal size, was gangrenous and distended with gas. It was covered and walled off from the peritoneal cavity, by the gastrohepatic and a portion of the great omentum. Surrounding the gall bladder was a pool of dark slate-colored purulent fluid. The omentum was deeply injected and stained by this dark fluid. The fluid was sponged away and the gall bladder opened. It contained gas only; the walls were moist and were distinctly emphysematous, crackling under pressure between the thumb and finger. The mucosa easily separated from the wall and both were gangrenous. In the upper portion of the cystic duct was an irregular stone about the size of a small hazelnut, imbedded in sand and gravel like millet seeds. No other concretions were found. The common and hepatic ducts were probed and found clear. The gall bladder was freed of further adhesions and removed, a drain being placed in the remaining portion of the cystic duct. A pocket above and one below the former position of the gall bladder were drained with cigarette drains. The convalescence was not marked by any unusual incident and the patient left the hospital March 16th. A slight mucus discharge continued for several weeks from the drainage fistula.

The feature of especial interest in this case is the emphysematous condition of the gall bladder wall and the distention with gas of the bladder itself. Of the bacterial flora present little can be said, as the material taken for smear and culture was accidentally destroyed. One might assume the presence of coli, probably the commonest form of gas producing bacillus incident to the gall bladder.

## THE TREATMENT OF THE APPENDIX STUMP AFTER APPENDECTOMY.\*

BY MURAT WILLIS, M.D.,

OF RICHMOND, VA.,

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THE method of disposing of the stump of the appendix has often been said to be the only unsurgical feature in the operation for appendicitis. As a topic of discussion, this question almost invariably arises when two or more surgeons meet together, and I have been particularly impressed by the interest shown in this subject at various medical meetings and in the clinics that I have visited. Furthermore, this subject has formed the basis of several articles in the current medical literature, and as some of the writers' conclusions are at such variance with my ideas on the subject I determined to communicate with a large number of representative operators in this country, and to tabulate and analyze their replies. In accordance with this plan, and at the suggestion of Dr. George Ben Johnston, letters were sent to one hundred and twenty-five surgeons, including all the members of the American Surgical Association, and other well known operators, so as to obtain a general and impartial view of the subject. Each of these men was requested to answer the following list of questions:

1. Do you crush or ligate stump?
2. Do you divide with knife or cautery?
3. Do you use any chemical in disinfecting?
4. Do you bury the stump? (a) If so, how? (b) If not, why not?
5. Have you observed any difference in the intensity or character of pain between cases when the stump is buried or unburied?

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\* Read before the Southwest Virginia Medical Society, Jan. 16, 1908.

6. Have you seen any ill effects arise from unburied stumps, if so, what?

7. Have you observed any harmful effects of any character from burying the stump?

One hundred and five replies have been received and the analysis of these reports has proved most interesting.

The answers to the first three questions show the minor differences of technique practiced by different operators: Forty-eight both crush and ligate the stump; 29 ligate without crushing; 13 crush but do not ligate; 7 either crush or ligate; 4 neither crush nor ligate.

In answer to question 2, the appendix is divided by the cautery by only 11 operators. The remaining number use either the knife or scissors.

Many surgeons evidently believe in the attempt to disinfect the stump: Thirty-eight use carbolic acid; 15 use carbolic acid followed by alcohol; 10 use carbolic acid occasionally but not as a routine; 4 use the cautery; 10 use chemicals other than carbolic acid or the cautery; 28 do not attempt to disinfect the stump.

The chief interest in compiling these statistics, however, lies in the answer to question 4. The analysis of the 105 replies show that 77 *always* bury the stump, 66 by ligating and inverting into wall of cæcum, 11 by invaginating the unligated stump into the cæcum; 11 *usually* bury the stump (leave unburied only in drainage cases); 3 have no settled method; 2 leave no stump; 11 never bury the stump; 1 does not answer the question.

Thus it appears that the stump is always buried by 73.3 per cent. and usually buried by 10.5 per cent. of the representative surgeons in this country, while only 10.5 per cent. make a practice of never burying the stump.

Post-operative pain has been stated by different writers as a defect in the different methods of handling the stump. Of 103 replies to question 5, 78 have observed no difference whether the stump was or was not buried; 20 are unable to answer (personal observation on only one method); 3 state

that pain is greater when stump is buried; 2 state that pain is greater when stump is left unburied.

In reply to question 6, 23 of the 105 reports make mention of untoward results that have followed simple ligation and leaving the stump unburied. The remaining answers state that they have not personally observed any ill effects, or else have had no occasion for observation because of the reason that they have never left the stump unburied. It seems worth while to mention in more detail these replies.

(1) Four cases of intestinal obstruction from adhesions of the bowel to the stump, two of which were fatal—Armstrong, Montreal.

(2) Many temporary fæcal fistulæ—Bevan, Chicago.

(3) One case of fatal peritonitis, one case of fæcal fistula—Blake, New York.

(4) Occasional fæcal fistula—Bryant, New York.

(5) Several cases with very bad adhesions, one case of persistent suppuration—Estes, South Bethlehem, Pa.

(6) One case slipped ligature—Gerster, New York. (Operation by a house surgeon.)

(7) One case adhesions on reopening abdomen—Gwathmey, Norfolk.

(8) One case stump leaked, abscess—Harris, Chicago.

(9) Occasional fæcal fistula—A. B. Johnson, New York.

(10) Post-operative adhesions common—H. A. Kelly, Baltimore.

(11) Two cases of ileus from adhesions—MacLaren, St. Paul.

(12) One case slipped ligature, peritonitis, death—Matas, New Orleans.

(13) Fæcal fistulæ common—Monks, Boston.

(14) One case of abscess, death—Munro, Boston.

(15) Three cases of intestinal obstruction from bands adherent to stump—Oliver, Cincinnati.

(16) Fæcal fistulæ, slow healing, oftener infection—Owen, Chicago.

(17) One case stump sloughed, death, autopsy—Rixford, San Francisco.

(18) Occasional fæcal fistula—Senn, Chicago.

(19) One case Fallopian tube found adherent to appendix stump—W. J. Taylor, Philadelphia.

(20) Persistent sinuses—Vander Veer, Albany.

(21) Fæcal fistulæ common—Watson, Boston.

(22) Fæcal fistulæ commonly result—Weir, New York.

(23) Fæcal fistulæ more common—Willard, Philadelphia.

In striking contradistinction to the many complications following the practice of leaving the stump unburied, I am very much impressed by the fact that in the replies to question 7, only 2 surgeons out of 105 state that they have ever observed harmful effects of any character after burying the stump. These are as follows:

(1) "In one case a stitch gave way during the first defecation (after calomel) and a large exudate developed with symptoms of perforation. The exudate, however, was absorbed and the patient recovered"—Gerster, New York.

(2) "Two secondary abscesses"—Mumford, Boston.

Intestinal hemorrhage following invagination of the unligated stump has been reported frequently in the current medical literature. Although no inquiry was made in my letter as to the incidence of hemorrhage, yet it is of interest to note that 10 of the 105 replies contain statements in regard to this point. Several of these operators say that they have seen hemorrhage in the practice of their colleagues; but in addition not a few interesting personal cases are cited, in several of which the abdomen had to be reopened because the patient was almost pulseless. Several deaths from hemorrhage are reported in this series.

Although comment is hardly necessary after merely tabulating these statistics, yet attention may be directed in a brief way to several points.

*Post-operative pain* is one of the arguments advanced by the exponents of the unburied stump. The brilliant researches of Lennander, however, on the absence in the visceral peri-

toneum of nerve fibres which convey the sense of pain, serve to thoroughly invalidate this assumption, and in full agreement with this is the clinical experience of the vast majority of operators.

*Infection*, and *abscess*, after burying the stump would seem from the analysis of these replies to be regarded in the light of a theoretical rather than practical objection to this method. It is to be noted that only 2 of the 105 operators, including the 11 who believe in leaving the stump unburied, report that they have observed any sequela of this character when the stump is buried, while no mention is made of any fatalities from this source.

*Adhesions* following burying the stump are not reported in a single reply, although in some of the articles by exponents of the unburied stump the liability of adhesions to the region of the buried stump is one of the objections to this procedure. That adhesions do occur when the stump is left unburied is only too apparent by the number of cases of intestinal obstruction reported in these statistics which were found to be due to adhesions of the unburied stump to the omentum, small intestine, or abdominal wall.

The chief objections to leaving the stump unburied appear in nearly one-fourth of the 105 replies. They are: (1) obstruction to the bowel; (2) slipped ligature, with escape of fecal contents into the abdominal cavity; (3) adhesions of the raw surface of the stump to omentum, abdominal wall, and various nearby viscera. Two personal experiences with the unburied appendix stump impressed me very forcibly with the defects in that method.

In the first case a myomectomy was done and a practically sound appendix was removed at the same time. As it was a perfectly clean operation, the appendix was ligated, amputated, and the stump allowed to fall back into the cavity. Two days after operation the woman developed post-operative distention of the bowel, the ligature was "blown off," with the escape of fecal contents into the abdominal cavity. Death occurred from general peritonitis, and the conditions as

described were confirmed at the autopsy. This case, to my mind, illustrates one of the most dangerous accidents that are liable to occur in any patient in whom the stump is simply ligated and not buried. Distention of the bowel may occur after any abdominal operation and it is easy to understand how the increased pressure within the bowel will balloon out the appendix stump into a pyramidal-shaped body, with the apex at the ligature, and the integrity of the bowel wall is thus jeopardized in every case in which any distention ensues.

Shortly after the above case was operated upon, a patient was admitted to Dr. Johnston's service with evident intestinal obstruction. Operation showed an unburied appendix stump adherent to the abdominal wall, and a kinking of the small intestine about this adhesion so as to cause a partial obstruction of the gut. The patient recovered after separating the adhesions, freeing the loop of intestine, and burying the appendix stump in the cæcal wall.

We always make it a practice to ligate and bury the stump of the appendix whenever practicable, and in following our results during the past three years I have never seen any ill effects that would lead us to make any change in our method of procedure.

I am very much indebted to the surgeons who replied to my letter and for the evident interest that they have displayed in this matter by personal letters and other communications.

## EXCISION OF CARCINOMA OF THE RECTUM BY THE COMBINED METHOD.

WITH REPORT OF THREE CASES.\*

BY JOSEPH A. BLAKE, M.D.,

OF NEW YORK,

Surgeon to Roosevelt Hospital.

THERE has been a distinct swing of the pendulum in the last six or seven years toward the combined method (the abdomino-perineal) for the removal of cancer of the rectum. As yet the comparative value of the operation cannot be said to be determined and therefore, the report of all cases treated by this method is still of interest.

Its completeness and thoroughness, the great desiderata of operations for carcinoma, are its chief qualifications for merit and, at the same time, its chief drawbacks, on account of the greater danger incurred. It remains to be proven whether the results in regard to recurrence are sufficiently better than by other methods to justify the additional immediate operative risk.

It seems to me that no definite procedure should be considered desirable for all cases but that the operation should be designed to meet the indications in each individual case. To be more explicit, I would perform the perineal operation in early and low lying growths in which the anal sphincteric control can be preserved and, in general terms, would reserve the combined method for larger and higher growths which otherwise would have to be approached by the sacral route and for those in which the anal sphincters have to be sacrificed. This statement, while in general terms correct, has to be further modified, as will appear later.

I also believe that, when employing the combined method, all hope of preserving the natural site for the outlet of the in-

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\* Read before the New York Surgical Society, March 11, 1908.

testine should be relinquished and that a permanent abdominal anus should be at once instituted. Exceptions to this last statement may occur in rare instances when it is exceptionally easy to draw the bowel down through the preserved sphincters. My reasons for preferring the establishment of an abdominal anus is that by this procedure the entire operation is rendered aseptic whereby the abdominal wound can be entirely closed and the perineal almost completely and with the minimum of drainage, advantages which are inestimable when the vitality of the patient has been lowered by a prolonged operation. For, if after removing the growth through the abdominal incision, the oral is united to the aboral segment either by the Maunsell method or through a parasacral incision, a second division of the bowel becomes necessary, the avenues of infection are opened and the operation is unduly prolonged. Even if the sphincter can be preserved, as in the Quénu method, the fixation of the oral end between its divided halves, consumes more time than the institution of an abdominal anus and introduces the element of infection into the perineal wound. Furthermore, in using the Quénu method, the temptation is always present either to divide the intestine too near the upper limit of the growth or to put it on too much tension, thus endangering its blood supply.

While it is often difficult to get the patient's consent to an abdominal anus, although it is far more efficacious and cleanly than an incompetent perineal or sacral one, I have felt so strongly about it that I have refused to operate unless I had consent for an abdominal anus in cases where the combined operation seemed best.

The advantages of the combined method have been dilated upon so often in various papers that it seems almost needless to repeat them. Besides, the opportunity of a far more radical removal than is possible by other methods, the chief advantages seem to me to be: first, that the abdominal approach permits a much fairer estimate as to the possibility of removal and, if on account of lymphatic or metastatic extensions, it is found to be impossible, the patient is spared a mutilating and danger-

ous operation: and secondly, that the convalescence may be much shortened on account of aseptic healing, as has already been mentioned.

The three following cases illustrate fairly well the above arguments.

CASE I.—Mrs. G., manicurist, aged thirty-two years, was admitted to the Roosevelt Hospital in May, 1905. For two years she had had hemorrhage from the rectum, the last amounting to a pint, on the day of admission. For two and one-half years she had had increasing constipation. For two years pain, chiefly when at stool. She had had one child two and a half years before admission, the delivery being instrumental. Local examination revealed a large mass two inches above the anus, filling the rectum. It was fixed, lobulated and soft and friable, bleeding freely. Neither a tube or enema could be made to pass through it. Numerous indentable masses were felt throughout the abdomen. There was a small umbilical hernia. The heart, lungs and urine were negative. The general nutrition was poor. The tongue was coated but moist. The red cells were 3,800,000. Temperature was 98.8, pulse 88, respiration 22.

Operation, three days after admission. Nitrous oxide, ether anesthesia. Trendelenberg position. An incision four inches long, was made through the linea alba to the pubes. The mass was found to extend upward to above the middle of the sacrum. No lymphatic involvement was made out. The intestine was divided at the lower part of the sigmoid flexure; the ends inverted and the oral end brought out through an intermuscular incision just within the left anterior superior spinous process of the ileum, and fastened there with a few sutures, the end being left unopened. The aboral end was then drawn down over the pubes, the superior hemorrhoidal vessels ligated, the reflections of the peritoneum divided with scissors on either side and then across the front of the rectum at the bottom of Douglass' cul de sac. The bowel was then freed down to the levators by blunt dissection. So far, the operation was practically devoid of hemorrhage. The abdominal wound was then covered with a moist towel and the patient placed in the lithotomy position. The anus was closed with a heavy purse string suture of silk and then its external surface cauterized with the Pacquelin cautery. The region was recleansed

and a sagittal incision made circumscribing the anus from the perineal body in front nearly to the tip of the coccyx. The dissection was carried up, removing the sphincters with the rectum and the bowel drawn down and out. The perineal wound was then repaired by suturing the levators together with catgut and the more superficial portions with catgut and silk worm gut, a tube being placed in the posterior angle for drainage. The patient was then again placed in the Trendelenberg position, the peritoneum repaired at the bottom of the pelvis and the abdominal wound closed with a tier suture without drainage. Time of operation, two hours and twenty-six minutes. She was returned to the ward with little shock. Temperature 98°, pulse, 120, respiration 40.

The post-operative course was exceptionally smooth; there was a reactionary rise of temperature to 101.8°, which immediately subsided to normal and remained so. The wounds healed per primam with the exception of slight infection about the drainage tube in the perineal wound. The intestine was opened at the artificial anus at the end of thirty-six hours. She was allowed up on the nineteenth day. The portion of intestine removed was distended and hardened in formalin. On longitudinal section it showed a remarkable valvular arrangement of the neoplasm. It involved three and one-half inches of the rectum, invading the perirectal tissues somewhat toward the hollow of the sacrum, and consisted of a number of dendritic masses filling the lumen and folded downward so that the fecal current could pass downward, but not even water could be injected upward. On section, it showed the structure of a malignant adenoma.

I have been unable to follow this patient further than that she was reported in good health six months after the operation.

The most noteworthy feature of this case was the remarkably smooth convalescence. The operation was very long, unnecessarily so, it being the first case I had done by this method. In my second case the length of the operation was shorter by nearly an hour. In this case, however, I was able to close the peritoneum over the intestine in the floor of the pelvis before it was removed and could, consequently, close the abdominal wound, the transfer of the patient from the

lithotomy back to the Trendelenberg position thus being saved.

CASE II.—Mr. W., a farmer, aged sixty-six years, was admitted to the Roosevelt Hospital in June, 1906. He had had hemorrhages from the rectum for one year and pain for six months. Obstruction had not been marked. He had been cauterized for piles. He had gradually lost flesh and strength. He had had pneumonia five years before, otherwise his previous and family history was negative. Local examination revealed an ulcerated growth in the anterior wall of the rectum, extending from just above the anal canal upward for a distance of three inches. It did not obstruct. His general condition was unfavorable. He was emaciated, somewhat anæmic; the heart sounds were feeble; the arterial walls thickened; the lungs emphysematous; the abdomen negative; the tongue coated; the urine contained a trace of albumen and a few hyaline casts: hemoglobin 75 per cent.; red cells 4,600,000. Temperature 98°, pulse 108, respiration 24.

Operation: Nitrous oxide gas anesthesia; time, one hour and thirty-five minutes. The same procedure was carried out as in the preceding case except as has been already stated, the abdominal wound was closed before removing the rectum through the perineal incision. In this case the levators could not be sutured together. Drainage was by a cigarette drain instead of by a tube as in the preceding case. The operation was followed by considerable shock and he was given an infusion, but at no time did his condition seem to be precarious. The highest temperature, 101.6°, was reached at the end of twenty-four hours, but immediately fell to normal, fluctuating between 99° and 101° for six days, after which it remained normal. The pulse fluctuated between 88 and 112 on the second day. The abdominal wound healed per primam but the cigarette drain did not drain properly and there was some infection of the perineal wound and about one-third of it healed by granulation. He was rather feeble and convalesced slowly but surely and was discharged, healed, at the end of five weeks.

The growth proved to be adeno-carcinoma.

He remained well for about twelve months and then failed rapidly, dying at the end of fifteen months, of "internal cancer," there being no evidence of intestinal recurrence.

This patient ordinarily would be considered an unfavorable subject for any operation, yet stood it well and made a satisfactory operative recovery.

In the following case a preliminary artificial anus became necessary on account of the development of acute obstruction resulting from perforation and periproctitis. It also illustrates under what difficulties the operation is possible.

CASE III.—Miss R., forty years of age, was admitted to the Roosevelt Hospital on July 9, 1907. The only history obtainable from her was increasing constipation for a period of six months, followed four days before admission, by a sudden stoppage and a feeling of discomfort in the rectum. Cathartics were taken without relief, but gas and small quantities of feces were obtained by enemata which were only given with difficulty. On admission, there was a growth extending from the upper portion of the anal canal upward, blocking the rectum and involving the posterior vaginal wall. It seemed to be immovably fixed but was not particularly sensitive. Her general condition was fair, red blood corpuscles 3,600,000, hemoglobin 80 per cent., leucocytes 12,200; polymorphonuclears 89 per cent., temperature 100.6°, pulse 98, respiration 24.

She was kept for five days under observation, the intestine being gradually emptied by irrigations and enemata. The obstruction seemingly increasing, an inguinal colostomy was done, the gut being opened on the second day after operation. When under ether, the growth was carefully examined and found to be fixed and apparently extensively infiltrating, which condition was afterward proved to be largely due to periproctitis. Two days later this became more evident and the abscess was opened by an incision lateral to the anus. The abscess extended to above the levators but gradually cleared up, when it was found that the growth, although extensively infiltrating, could probably be removed, which was done two weeks from the institution of the colostomy. Under nitrous oxide, ether anesthesia, the colostomy wound being isolated with rubber tissue, a five inch median incision was made, the patient being in the Trendelenberg position. The intestine was divided far enough below the colostomy to allow inversion and the remainder of the intestine with the growth, removed in the same manner as in the first case reported.

The perineal excision, however, was much more extensive, including the entire posterior vaginal wall, the ischiorectal fat and the greater part of the levatores ani muscles. The resulting cavity seemed enormous and was closed with difficulty. The operation consumed two hours and thirty minutes, being prolonged rather than otherwise, by the presence of the colostomy. She was returned to bed in marked shock, the pulse being 140 and the temperature 96°. She responded well to heat and an infusion. The highest temperature, 100.4°, was reached on the second day, but after that remained normal. Healing of the abdominal wound was immediate but the perineal wound closed slowly by granulation. She, however, left the hospital within three weeks with a small granulating sinus.

Examination of the specimen showed that a perforation had occurred at the upper limit of the growth which caused the proctitis and sudden obstruction. The difficulties of excision were greatly increased by the presence of this suppurating sinus and it seemed remarkable that healing of the perineal wound occurred as rapidly as it did. The entire absence of sepsis following the operation is also noteworthy. The after-course of this patient, however, was far less favorable. A pulmonary metastasis appeared four months after operation, she dying two months later. The metastasis evidently was due to implication of the systemic veins in the tissues outside of the rectum. There was no local recurrence. The growth was an adeno-carcinoma.

These three cases throw little light on the curative value of the combined operation. In regard to the immediate operative risk, they impressed me strongly with its comparative safety. Although the shock may be great, the entire exclusion of the element of infection by means of the institution of an abdominal anus remote from the operation wounds, is greatly in its favor. Although patients are momentarily depressed by the severity of the operation, there is nothing in the condition of the wounds to interfere with convalescence. The dangers of the operation therefore, are restricted to the ordinary ones of shock and the anesthetic, it only being necessary that the technique should be good to practically ensure success. My own experience and that of others, shows that the mortality

of the low operations is largely caused by sepsis. In personal communications with other surgeons, I have gained from them the impression that their mortality in the combined operation is higher than in the parasacral route. I am inclined to attribute this to the fact that in many of their cases, complicated suture operations are done, the abdominal anus not being resorted to. There are certain cases in which the combined operation should be avoided if possible, notably obese males, in whom all abdominal operations are attended with great danger, but particularly this one, on account of the difficulty of handling the fatty intestine in a narrow pelvis and the large incisions necessary. Moreover, women, not only on account of the roomier pelvis but because of their insusceptibility to pelvic invasions, are far better fitted for this operation than males.

A résumé of my present opinions in regard to this subject may be briefly stated as follows:

That no single operative procedure for carcinoma of the rectum should be always carried out to the exclusion of others.

That the decision between the perineal and combined methods depends chiefly upon the feasibility of preserving the efficiency of the sphincter ani muscle, provided the growth is removable by the low route.

That when the combined method is used, an immediate abdominal anus should be formed unless the continuity of the natural passages can be restored with exceptional facility.

That institution of a colostomy at a previous operation is an embarrassment rather than an aid.

## THE DIAGNOSIS AND PROGNOSIS OF TUBERCULOUS AND SEPTIC CONDITIONS OF THE KIDNEY.\*

BY GEORGE E. ARMSTRONG, M.D.,

OF MONTREAL, CANADA.

COMPARATIVELY recent and more exact methods of determining the organic changes in and functional values of the kidneys together with the experimental researches of Hanau, Baumgarten and his pupils, Hansen and Guiani, as well as those of Wildbolz, have added materially to our knowledge of the diseases of these organs and to our therapeutic resources. The kidneys are, in the majority of cases, the first of the urinary organs to be infected by the tubercle bacillus. That one kidney alone may be affected at first, the other remaining free for a considerable time is a fact established by a large number of observations. It is with these cases of unilateral renal tuberculosis that we as surgeons are chiefly concerned, and this class includes according to Garré and Erhardt about 10 per cent. of the tuberculous diseases.

Between June, 1905, and February, 1908, I removed 11 kidneys; 8 of these were tuberculous and 3 were cases of non-tuberculous pyonephrosis. Five of the patients were females and 6 were males. Of the 8 tuberculous cases 5 were males and 3 were females. The age in the tuberculous cases was from 21 to 41, the other 3 cases were aged respectively 48, 49, and 55.

The first symptoms in 3 of the 5 males were vesical tenesmus, frequency of micturition and hæmaturia. In one, frequency with pain but without blood, and in one, a sudden stoppage of the stream, followed by frequency. In the 3 women the first symptom was pain in the loin. Loss of weight was never a conspicuous symptom, although one patient had lost 30 pounds. Cystitis was present at the first examination in 6 cases; in 2 it was confined almost exclusively to the half

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\* Read before the American Surgical Association, May 5, 1908.

of the bladder on the diseased side. In 4 cases there were present at the first examination a distinct ulcer around the ureteral opening in the bladder on the diseased side. In one case the ureteral opening in the bladder was swollen and œdematous, but not ulcerated. Tuberculous epididymitis was present in two cases. The relative dates of the development of the disease in the kidney, bladder, and testicle could not be determined.

The diagnosis was made in each instance by examining the individual separate urines from each kidney, and finding tubercle bacilli in the urine from the diseased side. \*This examination was also made to demonstrate the presence of a second kidney and the functional value of each kidney separately. The findings in 4 of these cases have been published in the "Montreal Medical Journal," and are referred to by Dr. R. P. Campbell in his paper published in the ANNALS OF SURGERY. The details of the remaining 4 cases are as follows:

A. B., aged 29; English cotton-mill operative; married. Was admitted to the Montreal General Hospital for pain in the right loin of 6 or 7 weeks' duration. Slight at first and of a dull, aching character, it gradually became worse and compelled her to give up work. She had lost in weight. Her nutrition was poor—mucous membranes pale. In the right loin was a mass which could be easily palpated and which was, apparently, an enlarged prolapsed kidney somewhat tender on pressure. Amount of urine excreted in 24 hours  $32\frac{1}{2}$  oz. It was found impossible to catheterize the right ureter. The urine from the left kidney was drawn by a ureteral catheter, and that from the right was obtained from the bladder. From the right kidney came only pure pus, in which no tubercle bacilli could be found. Around the orifice of the right ureter was an ulcer. The urine from the left kidney was as follows:

Left Kidney	
Sp. gr.	1015.
Reaction	Acid.
Urea	8 grs. to 1 oz.
Alb.	Trace.
	Sugar present after phloridzin.
	No tubercle bacilli.
	Cocci.

The right kidney and ureter were removed and the patient made an uninterrupted recovery. A year afterwards she was confined in the Montreal Maternity Hospital, when an examination of the bladder was made and the ulcer was found completely healed. The woman seemed in perfect health. The removed kidney was large, with scarcely any renal tissue left. It was composed of large pockets filled with pus. The pathologist's report was "Tuberculous pyonephrosis."

The 6th case. W. J. K., aged 41.—Complained of frequency of micturition. Had had appendicitis 18 months before, and the appendix was removed. His first symptom was in the fall of 1906, when a sudden stoppage of the stream was noticed, but it soon started again. Pain sometimes felt in the penis and the bladder, with increased frequency day and night. Has never noticed blood in the urine, which, however, has gradually become muddy and thick. During the summer of 1907, felt a pain in his loins. Has lost in weight. No history of fever or night sweats. Cystoscopic examination shows acute cystitis over the left side of the bladder with mucopus and doubtful-looking tubercles, more especially about the left ureteral orifice, which is very red, wide open and irregular in shape, slightly ulcerated, and in normal position. The right orifice is normal and the right side of the bladder is almost quite healthy in appearance. The bladder holds 6 oz. with difficulty. Neck of bladder bleeds quite easily. Ureters were catheterized and the urine gave the following analysis:

	Right Ureter	Left Ureter
Reaction	Acid	Alkaline.
Color	Clear, yellow	Pale, watery.
Sp. gr.	1026	1006.
Urea	2.9 per cent.	.6 per cent.
	Blood cells (traumatic)	Numerous tubercle bacilli.
	No pus	Pus in quantity.

The kidney was removed on January 31, 1908. Adhesions were considerable. The kidney was enlarged, rough in appearance, and the capsule adherent.

The 7th case, Mrs. J. S. C., aged 33; married; has had 2 children. Pulmonary tuberculosis diagnosed in March, 1905. Pain in the left kidney about the same time. Never had any

hæmaturia. Pus in the urine was first discovered in April, 1906. The examination of the urine gave the following:

	Common	Right	Left
		15 c.c.	5 c.c.
Color	Turbid	Slightly cloudy	Bloody.
Reaction	Acid	Acid	Alk.
Sp. gr.		1018	Not taken.
Urea		2 per cent.	No urea.
Albumin	Alb.†	Tr.	Alb.†††
Pus	Pus	A few cells.	Almost pure pus
Tubercle bacilli	Tubercle bacilli present	No tubercle bacilli	Tubercle bacilli present
Staphylococci		Staphylococci.	

On palpation the left kidney was found to be enlarged to nearly the size of a child's head and tender on pressure. The pulmonary lesion is reported to be perfectly healed. The discomfort in the left side is considerable, and the bladder irritation extreme. Micturition sometimes as often as every 20 minutes, and as often as 20 times in the night, accompanied by pain and occasionally a speck of blood.

I removed the kidney and the patient made a very smooth and uninterrupted recovery. In 4 weeks the pain associated with micturition had entirely disappeared and the intervals had increased to 3, 4, and sometimes 5 hours, and on one occasion 6½ hours.

The 8th case, M. W.; female, aged 30.—Early symptoms simulated nephrolithiasis. An examination of the urines at this time, September 17, 1907, gave the following:

	Right Ureter	Left Ureter
	10 c.c.	10 c.c.
Sp. gr.	1012	1022.
Reaction	Acid	Acid.
Color	Straw	Blood.
Urea	1.8 per cent.	2.6 per cent.
	Alb.	Alb. tr.
	12 m nec. to red. 1 c.c. of Fehling	3 m nec. to red. 1 c.c. of Fehling.
	Δ—0.61	Δ—1.46.
	Pus in quantity	No pus.
	No tubercle bacilli	Red blood cells traumatic.
	Large and small bacilli	

A diagnosis of stone was made and one of my colleagues did a nephrotomy. The pelvis and calices were dilated and a cavity was present in the upper pole but no stone was found. A sinus persisted and small perinephritic abscesses formed and were opened from time to time. The case seemed clinically to resemble very closely the condition described by Brewer as "Acute unilateral hæmatogenous infection of the kidney." On the 28th of November, 1907, the urines were as follows:

Right Ureter		Left Ureter
Sp. gr.	1012	1022.
Reaction	Acid	Acid.
Urea	.6 per cent.	2 per cent.
	Pus	None.
		A few red blood cells (traumatic).
	$\Delta$ —.75	$\Delta$ —1.14.

I removed the kidney on the 6th of December, 1907, and the pathological report was that it was tuberculous, the pyogenic infection being secondary.

The chemical reaction was in each instance alkaline. The urine from the diseased kidneys was never acid; in 3 the urine was alkaline and in 2 neutral. In 3 cases, only pus was obtained. As acid reaction is a characteristic of tuberculous pyuria and a neutral and alkaline reaction an evidence of mixed infection, it follows that in every case there was a mixed infection at the time of examination. A disagreeable odor was generally present in those that gave an alkaline reaction.

After establishing a diagnosis of tubercle in one kidney, it becomes necessary to estimate, if possible, the extent of the disease, the functional value of the kidney and also to demonstrate the presence of a second kidney and its functional value. In the very earliest stage it is often difficult to find tubercle bacilli. They may be few in number. In the late stages, when the kidney is little more than a pus sac they seem to have died out, and to be difficult to find in the pus coming from the kidney.

These results correspond closely with those of Ekelhorn, who found bacteria relatively few in number in old cases in which the kidney after extirpation was found to be little more

than a pus sac with sclerotic walls and thin pus. The urine in such cases is very purulent and the bacteria few in number.

He reports a case of a woman 30 years of age who came into the hospital in 1902, with a diagnosis of tuberculosis of the left kidney. Numbers of tubercle bacilli were present in the urine—the disease was relatively recent. She was a strong able woman, and would not submit to an operation while she was free from pain. She left the hospital improved, and having gained 3 kilos in weight. In 1904, she was readmitted to the hospital. During this period of 2 years she had worked hard and felt well. Her only complaint was of frequent micturition. The tubercle bacilli in the urine were few in number and the pus greatly increased in quantity. The extirpated kidney was found to be in a condition of fully developed tuberculous pyonephrosis with thin fibrous walls.

Another of his cases was that of a young woman aged 22, with tuberculosis of the right kidney. In June, 1906, after lifting a heavy load she suffered for a few days from a painful feeling in the right lumbar region. She felt the pain only when she bent forward or straightened up. It was not sufficient to prevent her from continuing with her usual work, and in a few days she felt quite well. On the 5th of October, 1906, blood appeared in the urine, and at the same time right renal colic—generally two attacks a day, each one lasting 15 or 20 minutes. This sometimes continued for a week, when she seemed to recover perfectly, and could do her work as usual. On the 16th of November blood reappeared in the urine, but without pain. There were no bladder symptoms. In the urine were found pus-cells and numerous tubercle bacilli with only a trace of albumin. The number of tubercle bacilli in this case was great, while the number of pus-cells was small with here and there a red blood-cell. Only 6 c.c. of urine came from the right ureter during an hour. The urine was not pale, but had a normal color. That from the left kidney was quite normal. The kidney was removed on the 23rd of November, 1906, and the extirpated kidney showed comparatively small changes. When the kidney was split it appeared for the most part sound. The chief changes from the normal were found in the three papillæ.

Ekehorn draws the following conclusions: Numerous bacilli may be found in the urine in very early cases and the number of bacteria found at different times vary during the different periods of the disease. When a new part becomes involved, the bacteria are more numerous. With numerous bacilli there may be a small quantity of pus and with a large amount of pus the bacteria may be relatively few in number. When the pus is in large quantity and the bacteria few, the lesion is probably an old one with cavities and sclerotic walls.

If the pus in the urine is insignificant, then it is probable that no very large part of the kidney is involved, although many bacilli may be present.

The functional value of the diseased kidney is difficult to determine with certainty. A small amount of disease may materially lower its efficiency. This is very well shown in one of my cases where the kidney involved excreted urine turbid in color and neutral in reaction, sp. gr. 1007, urea 1.1 per cent., and only a trace of albumin—sugar present and a freezing point of  $-0.35^{\circ}$ —pus and tubercle bacilli. When the kidney was removed nothing was evident on or beneath the capsule, nor, indeed, was it at first apparent after longitudinal section had been made from pole to pole. On a more minute inspection one calix was found where all the points of the pyramids projecting into it showed macro- and microscopically typical tubercle formation. Hæmaturia had been a prominent symptom in this case. The kidney was removed because the hemorrhages were so large and recurred so frequently that he was becoming decidedly anæmic.

To establish the diagnosis pus must be found as well as tubercle bacilli, as in patients suffering from pulmonary tuberculosis the urine may contain tubercle bacilli and yet at autopsy no alteration in the kidneys be found. This has been noted by Jani and Schuschardt and others.

The determination of the functional value of the other kidney is of great importance and the results in my cases based upon an examination of the urine from this kidney have been found to truly indicate its efficiency.

LIEK, however, reports a case where such was not the case. The urines from the two kidneys in Liek's case were as follows:

Right	Left
15 c.c.	50 c.c.
Clear	At first turbid, later clear
Mildly acid	Alkaline
No sediment	Very rich in leucocytes
No albumin	Trace of albumin
After 0.01 Phloridzin: after 20 min. good reaction.	After 22 min. sugar reaction
Fr. pt. not taken.	Fr. pt. $-0.60^{\circ}$

From these findings it was concluded that the right kidney was sound.

An operation was undertaken to remove the left kidney but the infiltration of the musculature was extreme, extended down to the true pelvis, and the kidney could not be made out. While searching for the left kidney the condition of the patient became so bad that the operation was abandoned and the wound tamponed. The patient died a few days later. At the autopsy, this right kidney, which had, seemingly, good functional capacity, was found very much enlarged, 3 or 4 times its normal size. After longitudinal section was made, the pelvis and calices were found very much dilated; the kidney parenchyma pale, yellow and containing many miliary abscesses. Microscopically it showed extreme changes about the parenchyma and interstitial tissue—cloudy swelling and necrosis of the epithelium, small-celled infiltration and miliary abscesses. As Lick remarks, the case would seem to indicate that these methods of determining the functional value of a kidney are only of relative value.

In a 21-year-old man suffering from rupture of the urethra and severe pyelonephritis of the left kidney, the right kidney gave a clear urine in sufficient quantity in typical intervals without sediment and without albumin. After the injection of 0.01 of phloridzin, good sugar reaction appeared in 20 minutes. The electric test seemed normal. From this examination the removal of the left kidney was considered. At the autopsy this, apparently, sound right kidney was found in a condition of extreme congenital deficiency and not sufficient to maintain the blood of proper density.

Descending renal tuberculosis would seem to be three times as common in women as in men. In 464 cases of Albaran, Facklam, König, Czerny-Simon and Vigneron there were 127 males and 337 females. The ascending form is confined almost exclusively to men.

The two sides are affected with almost equal frequency, although Küster, after examining a large number of cases, thinks there is perhaps a little preponderance of involvement of the right side and suggests the association of this condition with floating kidney.

There can be little doubt that renal tuberculosis is seldom, if ever, really primary. If it is true that 90 or 95 per cent. of all adults have, or have had, tuberculous lesions, it would certainly seem that the kidney involvement must be, as a rule, secondary to some glandular, pulmonary or other tuberculous lesion. Vigneron and Israel found secondary tuberculosis in

50 per cent. of cases of so-called primary renal tuberculosis. The kidney lesion may, however, be primary clinically, that is, it may be the primary lesion in the urinary tract and the only lesion active at the time, yet a careful study of autopsies renders it doubtful whether it is not in reality always secondary.

The bacilli are generally carried in the blood-stream, although the kidney may be infected by extension from adjacent tissues, particularly the peritoneum, and one cannot deny that possibly the infection may, in some instances, ascend from the bladder to the kidney. The preponderance of descending or hæmatogenous infection is well established by the studies of Steinthals, and Simmond's autopsy reports. Clinically, the renal may be of a truly primary focus. Of the primary lesion there may be no evidence as to its situation or even of its existence. Baumgarten's experiments indicate that tubercle bacilli never go against the stream either in the blood or in the lymph-vessels. He injected a highly virulent pure culture into the urethra of rabbits and attempted in that way to produce a tuberculous ulceration of the bladder and prostate, but he never got the infection to spread up to the kidneys or the epididymis. To produce an ascending infection of the kidneys, it was necessary, after injecting the ureter with the culture of tubercle bacillus, to put a ligature around distal to the injection, in that way arresting the flow of urine. There was the same difficulty in producing infection of the epididymis from the bladder. Albarran, Bernard and Salomon had the same experience, failing to cause changes in the kidney by injecting tubercle bacilli into the ureter until retention of the ureter was artificially produced by ligature. To produce infection of the testicle, the testicle itself must be injected, and then infection may pass along the duct to the prostate. On the other hand, Wildbolz seems to have succeeded in infecting the kidney from injection into the ureter without ligature.

Clinically the other kidney may become tuberculous after the first one. In these cases there is sometimes present a tuberculous cystitis with perhaps a tuberculous ulcer around the ureteral opening of the first side affected. In these cases

Tuffier thinks that the infection of the second kidney is an ascending one. This view seems to have some support from the recent experiments of Wildbolz, but it is not supported by Albarran, Bernard and Salomon, whose experiments would indicate that the second kidney like the first is a descending hæmatogenous infection.

There is little doubt that the cystitis is secondary to the renal infection in the great majority of cases. Just how long before the bladder becomes involved I have not been able to determine. Ulceration in the bladder seems to begin just at the entrance of the ureter through the bladder wall where there is a moderate narrowing as if the bacilli were detained at this narrow point and there get in their work. These ulcers are sometimes distinctly crater-like.

In one of my cases the bladder was examined 3 years after the onset of symptoms. Cystitis and ulcer were then present. There had never, in this case, been any pain or frequency. In the second case, although cystitis and ulcer were present, there were no symptoms. In the third case, symptoms of frequency and pain had been present for 6 months, and in the fourth for 8 months, and in these cases the bladder symptoms had been among the first and most prominent throughout the illness. In the fifth and sixth cases there was no cystitis and no ulcer; in the seventh and eighth the cystitis was confined almost entirely to the lateral half of the bladder on the diseased side, and in one of them, No. 7, there was also present an ulcer around the ureteral orifice of that side. In both Nos. 7 and 8, the opposite half of the bladder and opposite ureteral opening were normal.

I do not think that in the cases in which the bladder symptoms were primary the kidney lesion had been an ascending one. In two of them the kidney, when removed, was very extensively diseased, being little more than a pus-sac. The bladder symptoms rapidly improved immediately after the nephrectomy, and in the third although the kidney lesion was small the bladder immediately recovered, and has remained well ever since.

It would seem that renal tuberculosis may remain comparatively latent for a long time, giving rise to few symptoms perhaps for years. In the eight cases upon which I have operated the disease in the kidney was obviously much older than that in the bladder.

Five of my patients were males and two of them had an associated tuberculosis of the epididymis. In both of these cases there was also present cystitis with ulcer around the ureteral orifice. The time of incidence of these two conditions is not known because we have no knowledge of the time when the cystitis and ulcer appeared. It is altogether likely that in these cases the testicular infection is also hæmatogenous.

In 4 of Israel's cases there was besides the renal tuberculosis a tuberculous epididymitis without any disease of the bladder.

The combination of tuberculosis of the urinary and genital organs in women is a rare occurrence.

Küster thinks an ascending kidney tuberculosis is only possible by spreading from the mucous membrane or through antiperistaltic contraction of the ureters. This retroperistalsis has been observed, but it can take place only when there is a stricture in the lower end of the ureter analogous to the ligature applied by Albarran.

I have been unable to discover any predisposing cause in my cases. None of them had suffered from trauma, none of them admitted having had specific urethritis, in none of them was the condition obviously associated with floating kidney, and none of the kidneys removed showed any congenital lobulation or anatomical abnormality.

In 5 of these cases the kidney, when removed, showed very extensive caseation, breaking down of tissue in the centre and at both poles. In one the kidney was very hard and contracted; in one there was nothing outside of the kidney and but one calix where all the surrounding tissue was tuberculous, the disease spreading in the surrounding tissue to the depth of three-sixteenths to one-quarter of an inch, the whole disease

occupying about 9 c.c. of kidney tissue. In this case hemorrhage was a prominent symptom.

Zondek and Israel give an anatomical reason for the frequent involvement of the lower pole of the kidney, namely, the occasional existence of an artery springing direct from the aorta and going to the lower pole of the kidney so that the infection becomes localized.

In advanced cases I have found the fatty capsule altered, and very much adherent to the capsule of the kidney and in one it was indeed very difficult to separate it from the kidney.

Marked involvement of the ureter was present in two cases. The etiology of the changes in the ureter may vary in different cases, but the explanation given by Aschoff seems to harmonize very well with the clinical findings. Aschoff thinks that the involvement of the walls of the ureter is an ascending lesion, secondary to the ulcer in the bladder, the infection spreading upwards through the lymphatics from the ulcer at the ureteral opening in the bladder; the ulcer itself being a descending lesion.

Some cases have been reported in which the infection seems to have spread along the mucous membrane of the ureter by direct continuity from the pelvis of the kidney. In two of my cases all the coats of the ureter were involved. In one it was thickened and shortened raising the cornu of the bladder and rendering catheterization of the ureter difficult; in the other the walls were soft and friable—the ureter felt unusually large and œdematous.

Cases are reported in which ulceration of the mucous membrane of the ureter has been followed by cicatricial narrowing and even total obliteration.

The question of the frequency of involvement of the second kidney is of great interest. The following figures put together by Vigneron throw considerable light on this question: In 322 autopsies the disease was unilateral in 132 or 41 per cent.; in 326 operated cases the disease was one-sided in 198 or 60 per cent. These figures speak in a general way of the accuracy of the findings during clinical examination and

the operating table. By the time these people come to autopsy, it would naturally be expected that both sides would be involved in a much larger proportion of cases.

In another case many of the symptoms of tuberculous disease of the right kidney were present, namely, pain in the right loin and along the course of the right ureter, pain and frequency of micturition and pyuria, the patient gave a typical reaction to tuberculin, and no sign of any other focus could be discovered. Nevertheless no tubercle bacilli could be found in the urine. She improved under rest and dieting, and I did not recommend operation.

The temperature varies in these cases, and is generally elevated when ulceration of the bladder is present, but, as remarked by Garrè and Erhardt, it disappears almost at once after the kidney has been removed, although cystitis and the ulcer remain. They conclude that the only view to take of this is that the temperature was due to absorption of infected urine by the ulcerated surface.

There is nothing characteristic about the enlargement of the kidney in tuberculous disease. The enlargement is moderate in ordinary cases when due to caseation and excavation in the poles of the kidney. When a pyonephrosis develops the enlargement may be considerably greater. When one kidney is diseased and does its work imperfectly the other may undergo a compensating hypertrophy and the enlargement from this compensating hypertrophy has been mistaken for enlargement due to the disease and the wrong kidney removed. If ureteral catheter specimens are examined, this error can be easily eliminated.

The examination of the bladder is of interest and shows that the disease is first located at the ureteral opening on the diseased side and later in the trigonum.

In the diagnosis Garrè and Erhardt recommended palpation of the ureters through the rectum or vagina. Here one feels a distinctly thickened ureter on the diseased side as a tender cord. If all other methods of diagnosis fail, there remains exploratory incision and the treatment of whatever

condition may be found. The early symptoms, and indeed sometimes the later as well, suggest stone in the kidney. Colic may be present in both conditions, but pyuria is an early symptom in tuberculous disease, and a late symptom in nephrolithiasis, and later the pain and frequency in micturition is not such a prominent feature in nephrolithiasis as in tuberculosis. The duration of tuberculosis of the kidney may extend over a long period,—10 or 15 years according to Czerny-Simons.

The prognosis in renal tuberculosis is very bad when not relieved by operative measures. It would be interesting to learn the results of climatic and tuberculin treatment in a series of cases of early renal tuberculosis. With the knowledge at present available it would seem that nephrectomy is the safer and more conservative plan. As to partial nephrectomy, a careful examination of the kidneys removed has seemed to demonstrate that such an attempt must necessarily prove uncertain and unsatisfactory. The difficulty of locating the disease and removing it altogether even after complete longitudinal splitting of the kidney seems to us to be unsurmountable, and the literature contains many cases of this so-called conservative surgery of the kidney which have resulted in permanent fistulæ and subsequent nephrectomy. Bilateral disease, colic, hemorrhage, retention, or localized abscess are the conditions which Czerny and Israel consider to call for nephrotomy. These conditions demand a palliative operation. When one kidney is in a condition of pyonephrosis, but still secreting a urine of sp. gr. 1007 and 1008, while the other kidney secretes urine of the sp. gr. of 1010 or 1012, it is impossible to sacrifice any secreting tissue without imperiling the proper consistency of the blood. In such cases nephrotomy is justifiable. One must in undertaking nephrotomy under these circumstances be prepared to put up with the annoyance of a persistent sinus through which more or less purulent urine may pass.

In general, nephrectomy is the operation of choice if the disease is limited to one kidney, and is advisable not only to relieve the patient from that focus of disease, but to relieve

the good kidney from the extra work entailed by the diseased kidney. The contraindications against nephrectomy are absence or imperfect functional power of the opposite kidney, evidence of incipient disease of the other kidney as indicated by the presence of albumin, a few pus-cells with tubercle or other bacilli. Cases are reported in which after the diseased kidney has been removed the other has improved, the albumin and pus-cells in some cases disappeared altogether.

The kidneys have been removed in each instance with their capsule. In none of them was there any special difficulty; in none of them were there any adhesions to the vena cava; the peritoneum was adherent in one.

The ureter has, in each instance, been removed to the level of the brim of the pelvis or a little lower. I have adopted the plan suggested by Mayo and injected the distal end of the ureter with 20 min. of pure carbolic acid and then tied it. The recovery from operation has, in each instance, been satisfactory. There has been no operation mortality. The quantity of urine secreted is disturbed wonderfully little. The secretion during the 24 hours succeeding any operation is, as a rule, less than usual. In my cases the quantity increased day by day until the normal was attained. Hypertrophy of the remaining kidney has been noticed in some cases.

The subsequent history of these cases has been dependent very largely upon whether ulceration of the bladder was present or not at the time of operation. In my first case the patient recovered perfectly at the time—left the Hospital well, and I learned that he died some months afterwards of acute miliary tuberculosis. The second case a year after operation was still suffering from frequency of micturition, being compelled to get up 4, 5 and 6 times at night. Cystoscopic examination at this time showed that the ulcer present at the time of operation was still present, possibly not so deep, or quite so large, but not markedly changed. During the year his general health had improved, and he weighed more than ever before, but the washings were too painful to be carried out

regularly. He was put upon tuberculin and given an injection every 10 days. Since then he has steadily improved. No examination has been made of the bladder since, but in my last letter from him dated March 21, 1908, he was passing an average of 50 to 55 oz. a day. He can now go 3 hours at a time with ease, and sometimes 4 hours and is only up twice at night. This is the condition 15 months after the removal of the kidney. In another case where an ulcer was present the pain has all disappeared and the frequency of micturition is very much diminished. In still another 2 months after operation the pain and distress in urination and the frequency are not much less than they were before the kidney was removed. In this case, like the other, the passage of an instrument was so painful that the man refused to have it done. He is at present taking guaiacol, and if an improvement does not follow, I shall put him on tuberculin. These results are in marked contrast with the rapid and complete disappearance of pain and frequency after the removal of a nontuberculous pyonephrosis. In one such case all bladder symptoms had passed away completely 5 weeks after the kidney was removed.

The continuance of pain and frequency in these cases with ulcer raise the question if it would not be better to be more radical and to remove the whole of the ureter with the cornu of the bladder. This procedure, of course, adds considerably to the severity of the operation.

Tuberculosis of the genital organs or bladder may become an urgent reason for nephrectomy rather than a contraindication, the pain of the bladder and distress generally improving markedly after the kidney is removed. Early bladder disease will almost certainly recover as soon as the kidney is removed, and even extreme cystitis with ulceration around the ureteral opening may recover, particularly if the diseased cornu of the bladder itself is excised as recommended by Kümmell.

The results obtained in renal tuberculosis are improving. Schmieden collected 201 cases of nephrectomy after renal tuberculosis; of these 142 or 71 per cent. recovered, and 59 or 29 per cent. died. During the last 10 years the mortality

has not been more than 24 per cent. Israel reports 29 nephrectomies; of these 14 were primary with sound bladders; 11 recovered perfectly. Küster had 11 permanent recoveries in 17 cases of nephrectomy, Schede 16 in 22 cases and Czerny 11 in 27 cases.

In conclusion I desire to express my appreciation of Dr. R. P. Campbell's kindness and dexterity in catheterizing the ureters in the cases that I have reported.

## TRANSPERITONEAL REMOVAL OF TUMORS OF THE BLADDER.

BY CHARLES H. MAYO, M.D.,

OF ROCHESTER, MINN.

THE general application of modern methods in the examination of diseases of the bladder has been of great value in making early diagnoses of tumors of this viscus.

With the aid of the cystoscope, portions of growths are removed by snares, forceps, or by curettes, and then washed from the bladder for examination. The result of the microscopical examination when considered with the location and extent of the tumor as shown by the cystoscope enables the operator to choose a method which will offer the greatest possibility of cure to the patient.

Cystoscopic examinations should be made by means of fluid distention of the bladder, as small pedunculated papillomata will float out in the liquid when they might cling to the mucosa in air distention and thus be overlooked.

In the natural evolution of the surgery of this region, which is still far from being crystallized, many changes from former methods of treating diseases and their complications have become necessary.

When we consider Watson's statement that operations in 28.6 per cent. of benign, and 46 per cent. of carcinomatous growths of the bladder have been surgical failures, we can see the necessity for early diagnosis, and the choice of a method of approach so that radical operations may be the rule and not the exception.

The ordinary routes of attack have been the suprapubic, infraumbilical, urethral, vaginal, or perineal.

The operative technic as made through the urethra, will naturally be chosen by those who become expert in the use of the cystoscope, but we believe that very few tumors will be eradicated by this route, and that it is not the best method

for the general surgeon. Watson shows that for an apparently simple procedure it is accompanied by a rather high mortality.

Of the other methods, the suprapubic is the most commonly employed. Through various abdominal incisions the bladder is opened in the Retzius space, great care being exercised to preserve the peritoneum intact. By this route papillomata have been removed with 20 per cent. mortality, carcinoma with 28 per cent., and sarcoma with 63 per cent., with early recurrence in over 20 per cent. of cases either benign or malignant, as given by Watson who has collected a large series of operations, the work of many surgeons. (ANNALS OF SURGERY, Dec., 1905.)

Considered from an operative standpoint we must recognize the fact that surgical failures are common in all kinds of tumors of the bladder above the prostate. Owing to the great tendency to recurrence as well as the possibility of a change in the character of benign growths, they must all receive radical treatment. Therefore, it is not my purpose in these remarks to devote time to the various tumors of the bladder from a pathological point of view, nor to those advanced cases which require the complete removal of the viscus. In this connection, we desire to call attention to the fact that the lymphatics of the bladder are few and inactive, which fact delays metastasis of malignant tumors, rendering them for a considerable period a local disease. Carcinoma confined to the bladder may be looked upon as curable by operation.

Clinically there occur: first, tumors with a pedicle; second, those with a broad base of attachment to the mucosa; third, those which involve the whole thickness of the bladder wall.

The latter variety may by continuity of tissue involve other organs; the prostate, ureter, urethra, or adjacent abdominal structures. Very large areas of the bladder, two-thirds or more, can be resected and the remainder will regenerate and dilate to a considerable extent, often forming a very serviceable organ, as pointed out by Harris. (ANNALS OF SURGERY, Oct., 1902.)

In an effort to develop an operation which would render all parts of the bladder accessible, the transperitoneal method seemed to be the most favorable. Watson (ANNALS OF SURGERY, Dec., 1905) has considered the removal of the unopened bladder through such an incision. F. Harrington (ANNALS OF SURGERY, 1893) has reported a case of chronic disease of the bladder treated by the transperitoneal incision. As a rule, when used at all, the method has been one developed without previous plan, of necessity or accident at the time of operation.

We have not been satisfied with the ordinary suprapubic incision in operating upon large tumors of the bladder, as, while several cases did exceedingly well, in two instances of cancer, we not only failed to cure the local condition, but unfortunately transplanted the disease to the abdominal wall and space of Retzius.

The usual result of imperfectly removed cancer is not only that relief is temporary, but the growth of the recurring tumor is usually more rapid and the condition of the patient, if anything, is worse than before the operation.

After securing the most favorable general and local conditions possible, the bladder being cleansed and emptied, an operation is made after the following method:

*Operation.*—The patient is placed in the high Trendelenberg position and a median incision made from the pubes upwards for six inches or more. The pelvis is well packed with gauze pads which hold the intestines in the upper abdomen. The abdominal incision is also protected by gauze pads. The bladder is caught by two tenaculum forceps lifted into the wound and opened by a two-inch median incision. The small amount of fluid in the bladder is absorbed with gauze and the incision is enlarged upward and downward until it is ample for the purpose. The tumors may be cut from the bladder with scissors and the denuded area burned with cautery.

Malignant growths involving the lower half of the bladder can be raised with tenaculum forceps and resected with a Pacquelin cautery. The area removed should include healthy

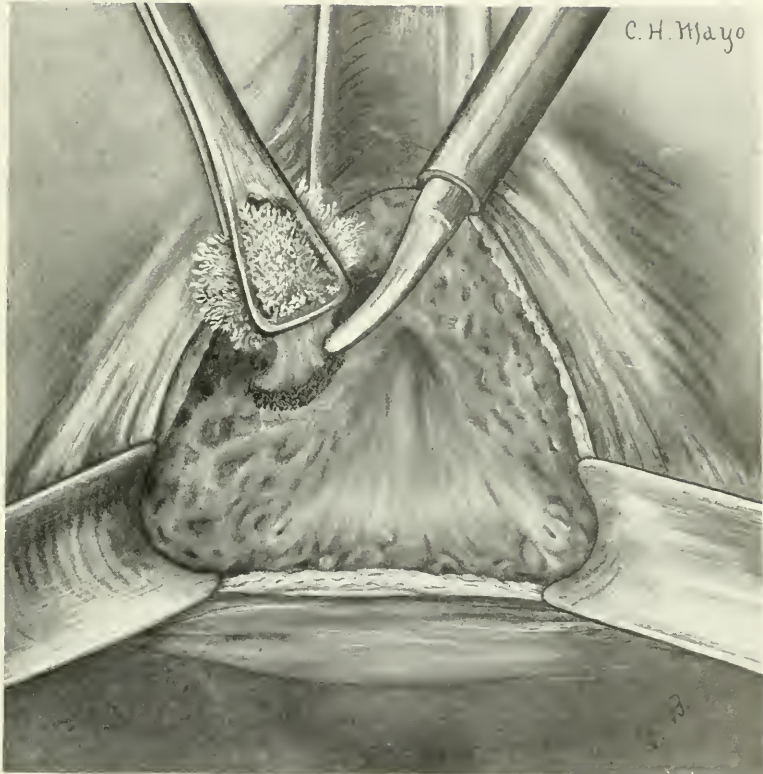
mucosa surrounding the tumor. No sutures are required to close these areas, the space being allowed to cicatrize.

When malignant growth necessitates the removal of a great part of the bladder, it is divided and removed freely, whether covered by peritoneum or not. In making the incision, one-third to one-half inch of tissue about the urethral entrance should be preserved if possible. If the bladder be involved at the ureteral opening, after the diseased portion of that viscus is removed, it is divided near the bladder and drawn into the abdomen through a perforation in the peritoneum close to the remaining half of the bladder, into which it is passed and where it is attached with catgut sutures. The peritoneum is closed over the exposed ureter in a fold by a few sutures, a method which insures rapid healing. The remaining portion of the bladder is now closed, often forming a greatly reduced but serviceable viscus.

The bladder wound, regardless of its size, is closed by a through and through continuous suture of catgut introduced in the original Connell method. This stitch is a running mattress suture and is passed through the entire thickness of the bladder wall, all loops pulling from the mucous side, and when drawn close, making a complete air-tight and water-tight continuous mattress stitch. The line of suture is now protected by a suture of silk, or preferably linen, applied as a Cushing parallel peritoneal suture, taking a square bite of the peritoneum first on one side then on the other of the line of closure, the needle being inserted parallel with the incision. This suture approximates the peritoneum and protects the primary suture just as when it is employed in gastrojejunostomy, and is used for the closure of all the bladder incisions and resections regardless of the amount removed.

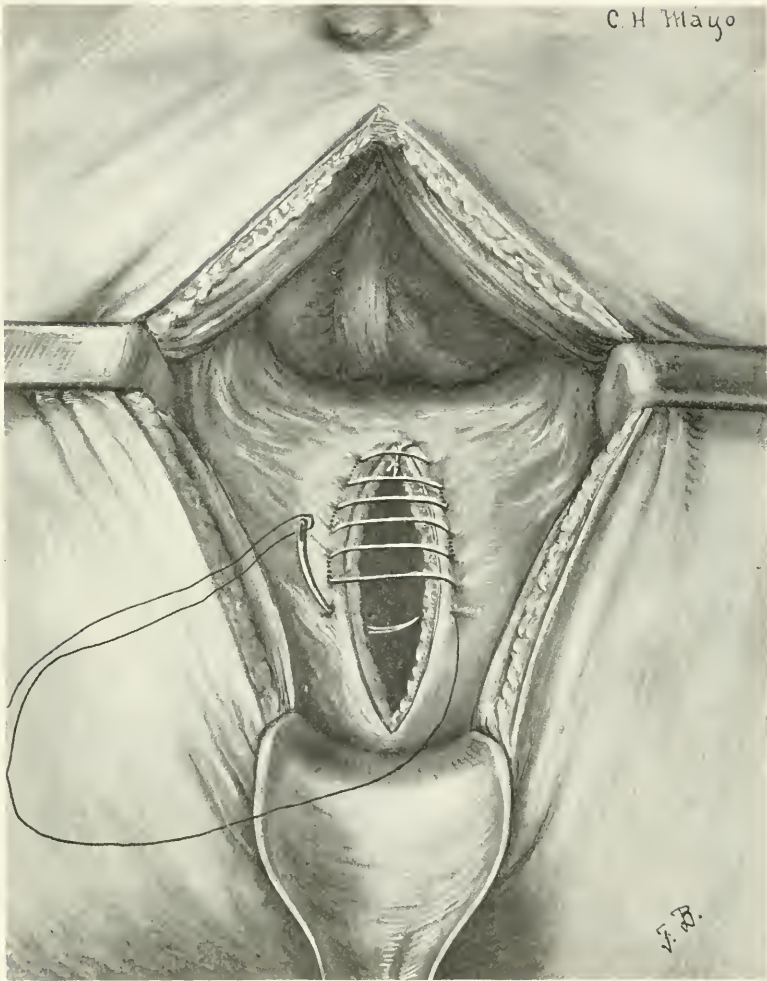
Should the bladder incision pass forward of the peritoneal fold, the closure will be the same, and is accomplished by drawing the bladder toward the abdomen and carrying the peritoneal fold to a lower level; the advantage of securing early peritoneal adhesions being developed to the fullest extent. As a rule the abdominal wound is closed without drainage, but

FIG. 1.



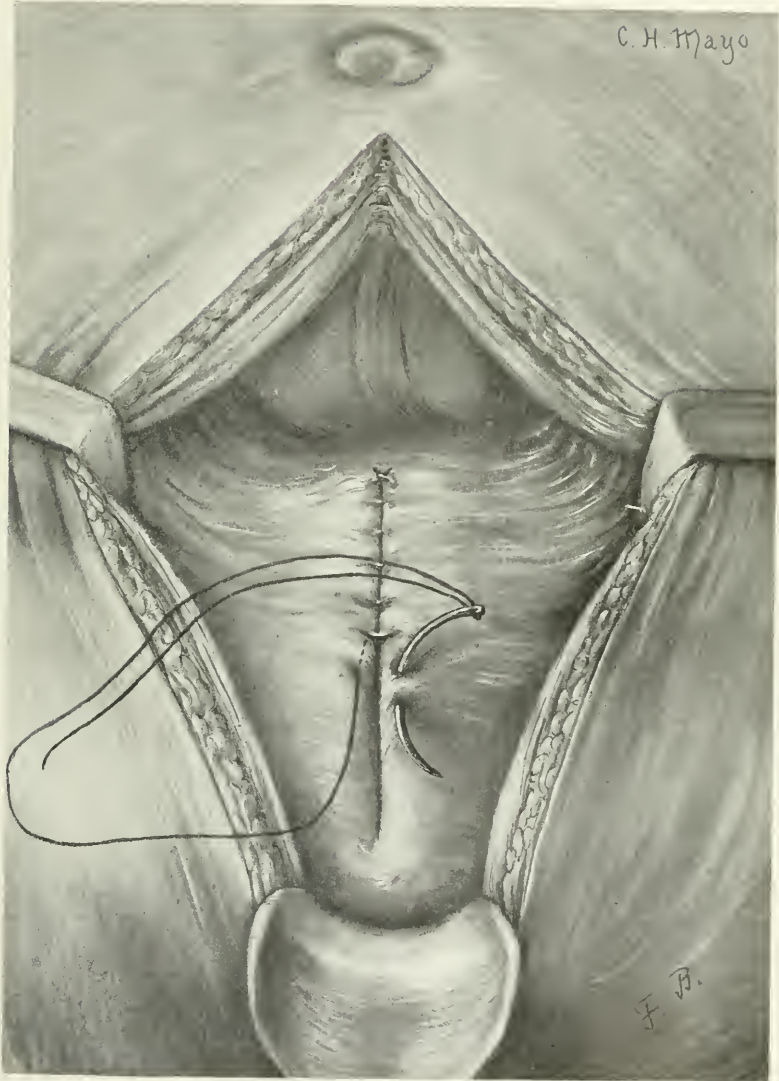
Cautery resection of papilloma of bladder

FIG. 2



Showing method of closure of bladder incision.

FIG. 3



Cushing peritoneal suture closing bladder wound.

FIG. 4.



Removal of large amount of bladder with transplantation of ureter.

should the general cavity of the peritoneum become soiled, a temporary drainage could be made through a stab-wound. The bladder is catheterized at regular intervals for the first few days following the operation, if it is necessary, but as a rule the patients void their urine at frequent intervals with little distress.

We have in five instances operated upon large papillomata of the bladder by the transperitoneal route, without mortality. Three of these tumors were carcinomatous, the others benign. A brief report of these cases is appended.

CASE I.—Male, 27. Ten years with bladder symptoms and more or less blood in the urine. Large sessile base. Carcinoma left side of bladder. Operation, 3-27-'07. Transperitoneal resection of over one-half of the bladder with transplanting of left ureter into the right half of the bladder. Bladder drained by perineal incision. Voluntary urination with control of bladder after first three or four hours. In the fourth week all drains closed.

CASE II.—Female, 39. Duration of symptoms two years. Blood in urine one year with much local pain. Cystoscope disclosed three tumors of lateral bladder wall, two small and one as large as a lemon. Operation, 5-1-'07. Transperitoneal with cautery resection of malignant papillomata. Bladder incision closed. Urine voluntary. Case well at examination after ten months.

CASE III.—Male, 50. Duration of symptoms sixteen months. Blood in urine almost constant. Papilloma size of small orange. Benign. Operation, 6-14-'07. Transperitoneal, and excision with cautery. Bladder incision closed without drainage.

CASE IV.—Male, 49.—Slight symptoms two years. Blood in urine three months. Operation, 12-7-'07. Transperitoneal removal of sessile carcinoma size of walnut near base over left lobe of prostate. Four inches bladder resected with cautery. Prostate removed through same incision. Suprapubic drain. Voluntary urination with healed drains in three weeks.

CASE V.—Male, 54. Duration of symptoms two years. Blood in urine one year. Tumor, right wall, size of walnut. Operation, 1-8-'08. Transperitoneal resection, cautery.

# AINHUM,

WITH REPORT OF A CASE.\*

BY EDMUND A. BABLER, M.D.,

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ALTHOUGH practically half a century has elapsed since Clark, in a monograph read before the Epidemiologic Society of London, called attention to this peculiar disease affecting the natives of Brazil, the characteristic feature of which is the spontaneous amputation of the affected fingers and toes, it is true that we know very little concerning ainhum.

The disease has been observed in various parts of the civilized world, although only about twenty-four cases have been observed in the United States; the present case being probably the first one reported occurring in Missouri. The literature reveals the fact that the disease is very prevalent in India. The patient is usually a negro; not more than four cases have been reported in which the patient was a Caucasian.

The etiology of ainhum remains an open question. The researches of da Silva Lima led him to regard the disease as due to injuries to the toes, while Scheube contended that ainhum was a trophoneurosis. Zambaco Pacha believed the disease to be a lesion of leprosy. Wellman has recently stated that he agrees with McFarland, who said: "The true cause of the fatty and atrophic changes in the amputated toe is not determined; it may be trophic, or it may depend on local cicatricial formation." In Wellman's opinion, the chigger may play an important role in prolonging the irritations and inflammations set up by wounds at the base of the toes. The probability of a parasitic origin has been scouted by many;

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\* From Surgical Dept., Washington University, Service of Dr. H. G. Mudd.

personally, I feel that time may prove the disease of parasitic origin. It certainly does not seem at all plausible that such a destructive process could be brought about by sharp grasses and the like, as has been long advocated by several observers. The fact that the disease has been observed in persons who have reached the meridian of life and who have worn shoes constantly since adolescence, tends, I think, to overthrow da Silva Lima's theory. Possibly we may find that uncleanliness advances the development of the disease. Many of the theories that have been advanced by the early writers are quite preposterous. Dupouy has observed the occurrence of loin pains at the commencement of some of his cases, and the tendency of the disease to run in families.

Unna regards ainhum as a primary degeneration of the epidermis. It is, in Unna's opinion, a sort of ring-formed sclerodermis, with callous formation of the epidermis, leading to secondary total stagnation necrosis. The horny layer is much thickened, and the papillæ are elongated and narrowed. In the papillary body, there is cellular infiltration; the papillary vessels are dilated, and the larger and deeper-lying vessels of the cutis and the hypoderm show obliterating endarteritis in different stages of development. The membrana propria is thickened. In discussing the pathology, Brayton says: "These are the progressive changes found in stagnated dermatoses. When the stratum corneum becomes thickened even in small areas, as in corns, atrophy of the underlying epidermis occurs. It is to be expected, therefore, that, with this hyperplasia of the epidermis and downgrowth of the interpapillary process, the corium should show an increase of fibrous tissue and fat; that owing to pressure there should be changes in the deeper blood-vessels and arteries; an increase of the adventitia or intima coats of the arteries so that the lumen is impaired, and finally obliterating endarteritis with slow gangrene. Eventually the constricting band approaches the bone; tumefaction of the toe occurs with stagnation of lymph and fat, gradually causing degeneration of all the constituents of the above tissue, pulp and cutis; a

condition of rarefying osteitis takes place, with final disappearance of the ungual phalanx, the partial disappearance of the second, and almost always the preservation of the third. The line of division may occur through the middle of the proximal phalanx or at the proximal interphalangeal articulation."

In our case, the patient's attention was first called to a small nodule situated on the dorsal surface of the little toe of the right foot, just at the edge of the phalangeal-metatarsal articulation. The nodule deepened and extended to the inner side of the little toe, eventually causing constriction, and the other clinical manifestations of the disease in question. The true pathology of *ainhum* will continue to remain in question until the etiology of the disease has been determined.

The clinical manifestations of *ainhum* are quite constant. The disease begins, as a rule, with a crack, fissure or nodule at the base of the toe on either the plantar or inner side. In our case, the patient's attention was first attracted to a small nodule on the dorsal surface at the base of the little toe; itching was present. The fissure deepens, gradually encircling the toe. Ulceration, bleeding and discomfort are seldom present. The distal portion of the toe becomes rounded and ball-like in appearance; it may be wider transversely than anteroposteriorly. The disease progresses very slowly; it may require ten years to completely sever the toe. Pain is seldom severe; in our case, however, the patient suffered so much at night that he could not sleep. The toe is frequently subjected to trauma.

Ulcers may appear late in the course of the disease. Palpation may be painful to the patient. When the bone has been destroyed and the toe is but loosely attached to the foot, the patient may complain severely of pain on walking. The distal portion of the toe may seem perfectly healthy; sensation may not be impaired. The medical attendant seldom sees these patients during the early course of the disease. In some instances the patient does not present himself for treatment until several of his toes have been spontaneously amputated.

PLATE I.



D. Babler's case of ainhum.

PLATE II.



Longitudinal section of toe. Note constriction.

The diagnosis is not difficult. In Raynaud's disease there are preliminary lesions such as bullæ, vesicles, edema, etc.; constitutional symptoms are present; the lesions are symmetrical. In leprosy there are other manifestations of the disease, on other regions of the body pointing to the true character of the affection; preliminary manifestations precede the destructive process. The mere fact that there is a constricting band at the base of the toe causing gradual amputation of the affected appendage should arouse suspicion.

The prognosis depends upon the degree of destruction present at the time that the patient comes for treatment. Conservative treatment has been unsatisfactory because the medical attendant does not see the patient early enough. Linear incision and antiseptic dressings will probably suffice in the early cases. Amputation is indicated when the disease has produced absorption of the bone. The necrotic mass found in some cases should be evacuated and the sac walls swabbed with carbolic acid; then cleaned with alcohol, and dressed daily.

*Report of Case.*—James A., aged 50, a colored man, presented for treatment at the Surgical Clinic of the O'Fallon Dispensary, and gave the following history: Born in Virginia, where he remained five years, then moved to Alabama, residing in the latter state for twenty-five years; moved to Tennessee, and seven years later he came to Missouri, where he has lived during the past thirteen years. The family history is negative. Patient has always enjoyed good health until nine years ago, at which time he contracted syphilis. Three years thereafter, gummata appeared on both sides of neck. About six years ago he suffered a paralysis of right side of face; appeared suddenly and has remained.

About a year ago the patient observed a small warty-like growth on inner side near the dorsal surface at the base of the little toe of the right foot. He removed it by means of his pocket knife. Within a few weeks a similar but larger growth presented at the same side, and continued to grow; within three months it had partially encircled the base of the little toe. His attention has been frequently called to the growth owing to the presence

of more or less pain in the base of the affected toe. A singular feature is the fact that the pain has been worse at night. During the past five months the distal portion of the affected toe has been gradually assuming the appearance of a ball; the hard dense growth which has extended around the circumference of the toe has gradually produced absorption of the bone; the toe may be moved as though it was but slightly adherent to the foot.

Examination shows the usual findings in ainhum. The reader is respectfully referred to plate I. Leprosy was readily excluded. The glands of the neck were found swollen and firm; not painful; evidence of frequent incisions. The right side of face is paralyzed. At the base of the little toe of the right foot is a semi-solid mass which presents the appearance of being a continuation of the destructive process observed in the little toe. Pressure causes pain.

Amputation of the affected, and practically destroyed toe, was advised. A few days later the toe was removed under a local anesthetic. At the base of the little toe, just internal to the phalangeal-metatarsal articulation, was found a necrotic, bloody-looking mass about as large as a small hazelnut, which led me to believe that the disease was extending to the ring toe. The parts were thoroughly swabbed with pure phenol and then with alcohol. The incised surfaces were apposed by means of sutures, and the parts dressed with moist bichloride gauze. Owing to the fact that the patient would not consent to enter the Washington University Hospital, he was compelled to return home; he placed more or less of his weight upon the right foot, thereby causing two of the sutures to cut out. At the end of ten days the parts had, however, healed. At present the patient can walk and work without discomfort.

Plate II. is a beautiful reproduction of a longitudinal section of the diseased toe. The tissues on the inner side of the constricted portion of the toe were of such firm consistency that the microtome would scarcely cut through them. This is the first longitudinal section that I have seen in any publication. I am deeply indebted to Dr. Tiedemann for his kindness in making microscopic sections, and to Dr. H. G. Mudd for permission to report the case.



FIG. 1.



Arrest of growth at lower end of radius following fracture involving the epiphyseal line.

## ARREST OF GROWTH AT THE LOWER END OF THE RADIUS AFTER SEPARATION OF ITS EPIPHYSIS.

BY ADOLPH WAECHTER, M.D.,

OF NEW YORK.

Instructor in Surgery in the New York Post-Graduate Medical School.

MASTER R. B., 11 years of age, sustained a Colles' fracture of the left hand by a fall two years ago. The hand was set and treated without any subsequent deformity or limitation of motion. As the boy grew older, his parents noticed a gradually increasing abduction of the left hand and a projection of the ulna. At the same time there was limitation of motion in some directions. They ascribed the deformity to the fact that the fracture had been improperly set. Upon examination, it was found that the hand was markedly abducted, adduction was absent, though flexion and extension were practically normal, supination and pronation limited. The radius was found to be one inch shorter than the ulna.

The X-ray examination shows two normally shaped bones, but the radius shorter than the ulna (Fig. 1). The epiphysis of the radius is united firmly with the diaphysis in the centre by bony tissue. There being no distinct demarcation as in normal bones between epiphysis and diaphysis. The probable pathology is that, the cartilaginous portion having undergone bony changes, the osteoplastic function of the epiphysis is destroyed; as the result the radius is stunted in its growth, causing deformity. These changes of permanent ossification take place about the twenty-second year, but also can be brought about by irritation of the epiphysis, as has been shown by animal experiments. The latter may be the cause in this case as the result of improper immobilization of the fragments. Fractures of the epiphyses are very frequent in young people, especially in the radius, the latter being the most frequent form of fracture of the human skeleton next to the ribs. The injury is pro-

duced by a cross-strain, the limb having been bent beyond the normal limit or direction where there is no motion.

P. Bruns collected 81 cases of epiphyseal separations, with deformity as the result of retarded growth, the most frequent site being the femur with the radius following. Most cases occurred during the years of ten to nineteen.

Among the 81 cases, there were 25 of retarded growth of the radius.

Stimson, in his large experience, only saw 2 cases.

The treatment of the above case is resection of the ulna in order to restore the functions of the wrist joint and correct the deformity.

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## STRAIN-FRACTURES OF THE KNEE.

BY SIDNEY LANGE, M.D.,

OF CINCINNATI, O.

Radiographer to Cincinnati Hospital.

THE Röntgen era has brought to light many strange and hitherto unsuspected types of fractures.

Many of these recently discovered fractures are of the indirect variety, that is, fractures due to ligamentous or muscular strain rather than to direct violence. Such fractures were formerly diagnosed and treated as "sprains." To-day the diagnosis of "sprain" is justifiable only after a Röntgen examination has shown the absence of a fracture.

The most familiar type of fracture from ligamentous strain (indirect violence) is the Colles' fracture of the wrist. It is the purpose of these few lines to call attention to a type of fracture of the knee-joint produced in an analogous manner.

A glance at the anatomical make-up of the knee-joint establishes at once the possibility and plausibility for the occurrence of indirect or ligamentous strain fractures. The knee-joint is one of the most superficial and as far as adaptation of the bony surfaces goes, one of the weakest joints in the body, for in no position are the bones in more than partial contact. Its strength lies in the number, size and arrangement of the ligaments and the fascial expansions which pass over the articulation and enable it to withstand the leverage of the two longest bones in the body.

The strongest and most important of the ligaments that unite the two component bones of the knee-joint are: (a) patellar ligament, (b) internal lateral ligament, (c) external lateral ligament, (d) posterior ligament, (e) crucial ligaments,—anterior and posterior.

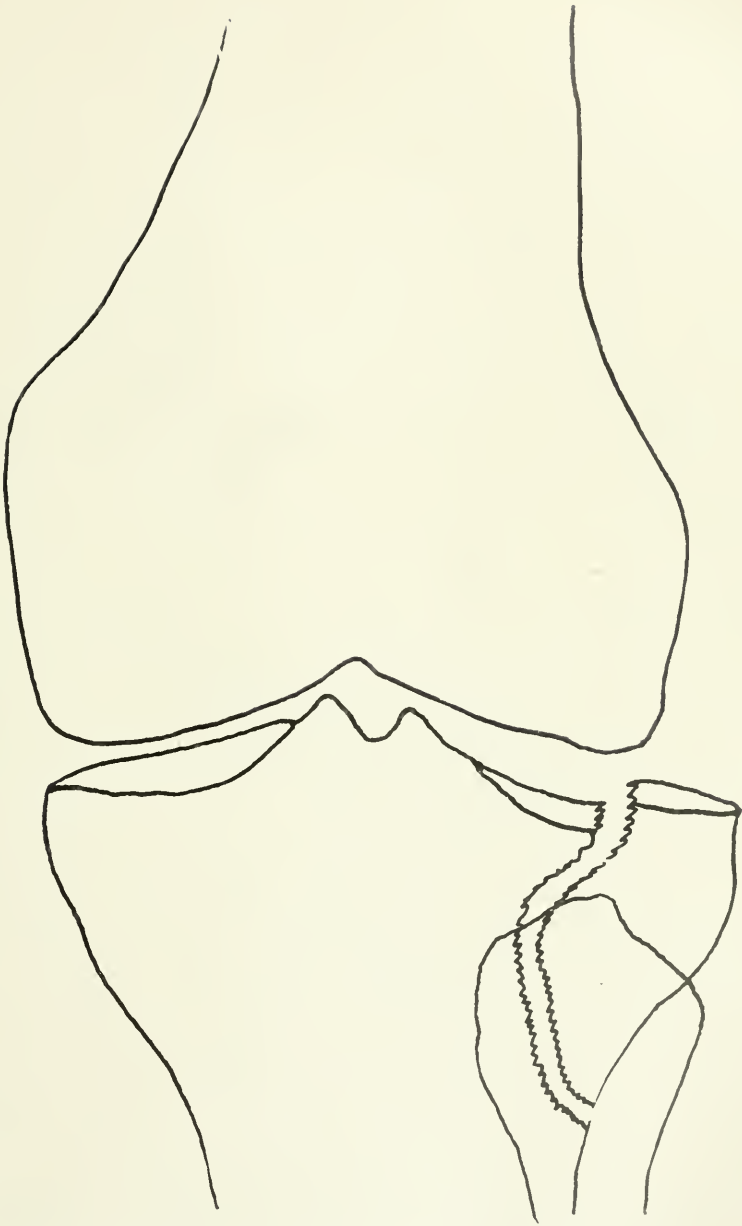
The patellar ligament is tense in flexion, relaxed in extension. Acting in conjunction with the anterior portion of the joint capsule, it limits excessive flexion. Sudden strain

in partial flexion frequently results in transverse or indirect fracture of the patella. The internal lateral ligament extends from the internal condyle of the femur to the shaft of the tibia below the inner tuberosity. It is tense during extension but relaxed during flexion. The external lateral is attached above to the external condyle of the femur. Below it divides into two portions, one of which is attached to the head of the fibula, while the smaller posterior portion joins the strong posterior ligament, to be attached to the outer tuberosity of the tibia. Like the internal, the external lateral ligament is tense during extension but relaxed in flexion. The lateral ligaments withstand the lateral strains upon the joint. They also check hyperextension and outward rotation.

The posterior ligament bounds the popliteal aspect of the joint and limits extension. The crucial ligaments play the most important part in maintaining the integrity of the knee-joint. The anterior crucial ligament is attached to the fossa in front of the spine of the tibia and to the anterior part of the ridge which separates the inner and outer tibial articular facets and is closely connected with the anterior end of the internal semilunar cartilage. The posterior crucial ligament arises from the fossa behind the tibial spine as well as from the space between the two tubercles which go to make up the tibial spine. It receives fibres from the posterior ligament and from the external semilunar cartilage. The crucial ligaments are inserted above to the mesial aspects of the inner and outer femoral condyles. They are more or less tense in all positions of the knee-joint, with the possible exception of flexion. They limit extension and (the anterior crucial) inward rotation. In conjunction with the lateral ligaments they prevent forward and backward sliding motions. Their function in flexion is somewhat unsettled. Treves insists that they become tense in flexion and thus limit over-flexion.

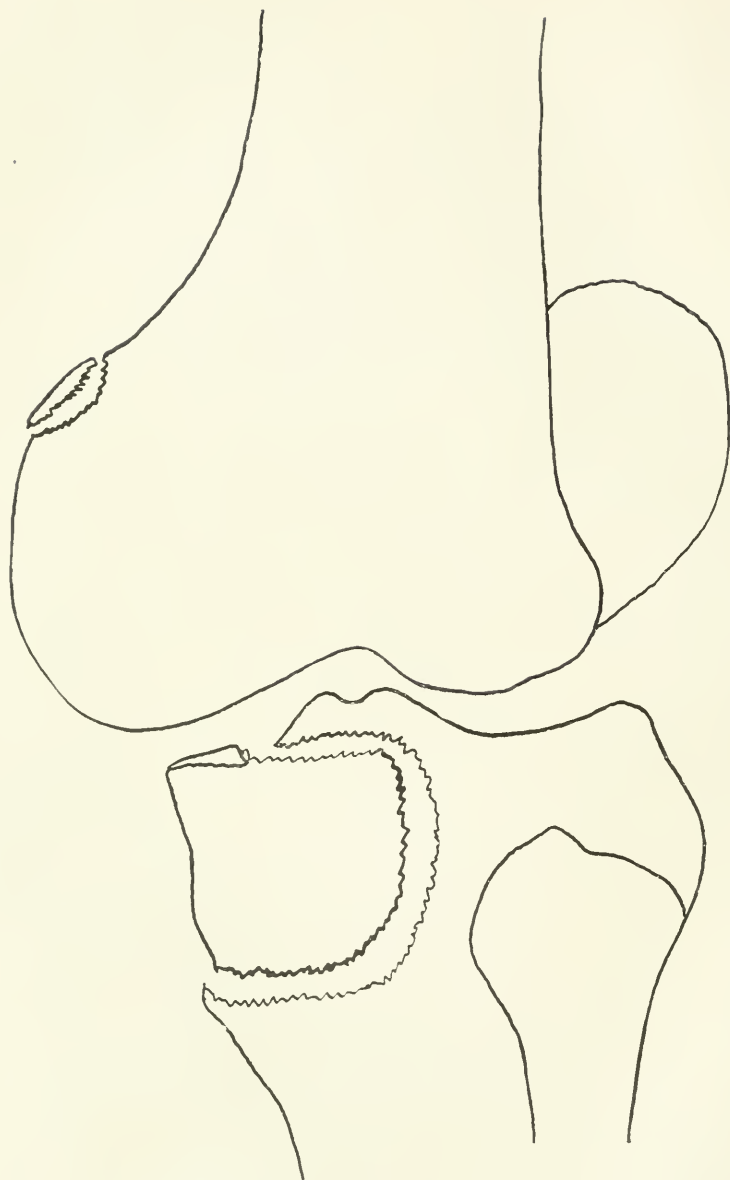
In studying the effects of strain upon the knee-joint in various directions, we may dismiss at once the flexion strain against the resistance of the patellar ligament and its subtended muscles, for we are well acquainted with the transverse

FIG. 1.



Avulsion of external tuberosity of tibia. Outline from a skiagraph.

FIG. 2



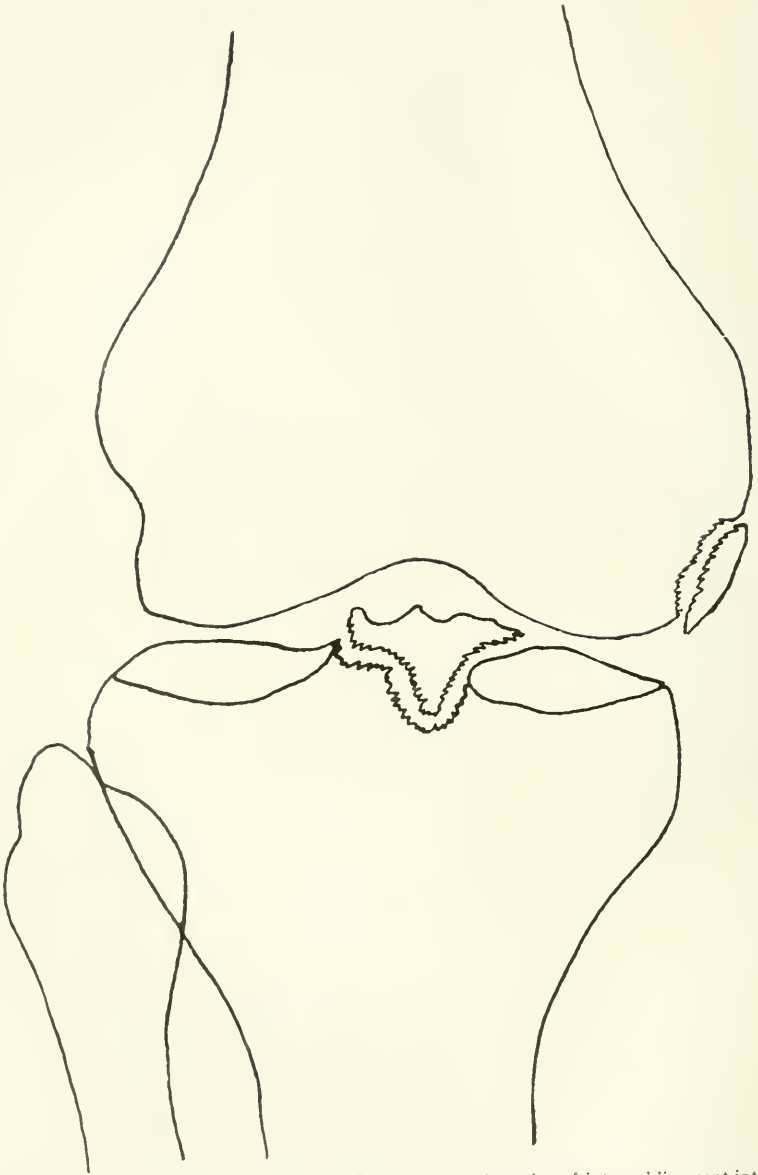
Avulsion of fragment from the internal tuberosity of head of tibia with tearing off of small scale from internal tuberosity of the femur. Outline from a skiagraph.

FIG 3



Crucial ligament fractures. Outline from a skiagraph.

FIG. 4.



Crucial ligament fracture ; with tearing away of scale at insertion of internal ligament into femur. Outline from a skiagraph.

patella fractures which most commonly follow such violence.

We have then to consider:

(a) Strain in the direction of hyperextension against the crucials, the posterior and the lateral ligaments;

(b) Strain exerted laterally against the internal or external lateral ligaments, the knee being in extended position, which puts these ligaments on the stretch;

(c) Strain in a rotatory direction, either in the direction of outward rotation, which is normally limited by the lateral ligaments, or in the direction of inward rotation, which is normally limited by the anterior crucial ligament.

It should be understood that the above scheme is arranged simply for the purpose of discussion and that in any given case the strain will be exerted in several directions simultaneously.

The following four cases served to call the writer's attention to the frequency of strain-fractures about the knee.

CASE I (from the service of Dr. J. C. Oliver).—Mr. C. W. K. While attempting to board a moving street car, the patient missed the car step, "twisted his knee," and fell to the ground. He at once arose, experiencing only slight pain in his knee (right) and walked six squares when the pain became so intense that he was compelled to sit down in a neighboring drug store, whence he was removed to the Cincinnati Hospital. *Examination of the knee showed no evidence of direct trauma to the soft parts.* A skiagraph (sketch 1) showed a tearing off of the *external* tuberosity of the tibia, the line of fracture running into the knee-joint.

CASE II (from the service of Dr. J. C. Oliver).—Mr. C L. Patient was injured in a street car accident. The left femur was fractured about two inches above the knee. *The right knee showed no evidence of direct trauma* and exhibited no positive signs of fracture of its component bones, but the severe pain on manipulating the joint suggested the need for a Röntgen examination. The skiagram revealed a tearing off of the *internal* tuberosity of the tibia as well as a small fragment off the internal condyle of the femur, evidently a strain-fracture (sketch 2).

CASE III (from the service of Dr. C. E. Caldwell).—Mr. McD. while wrestling accidentally twisted his left knee and fell

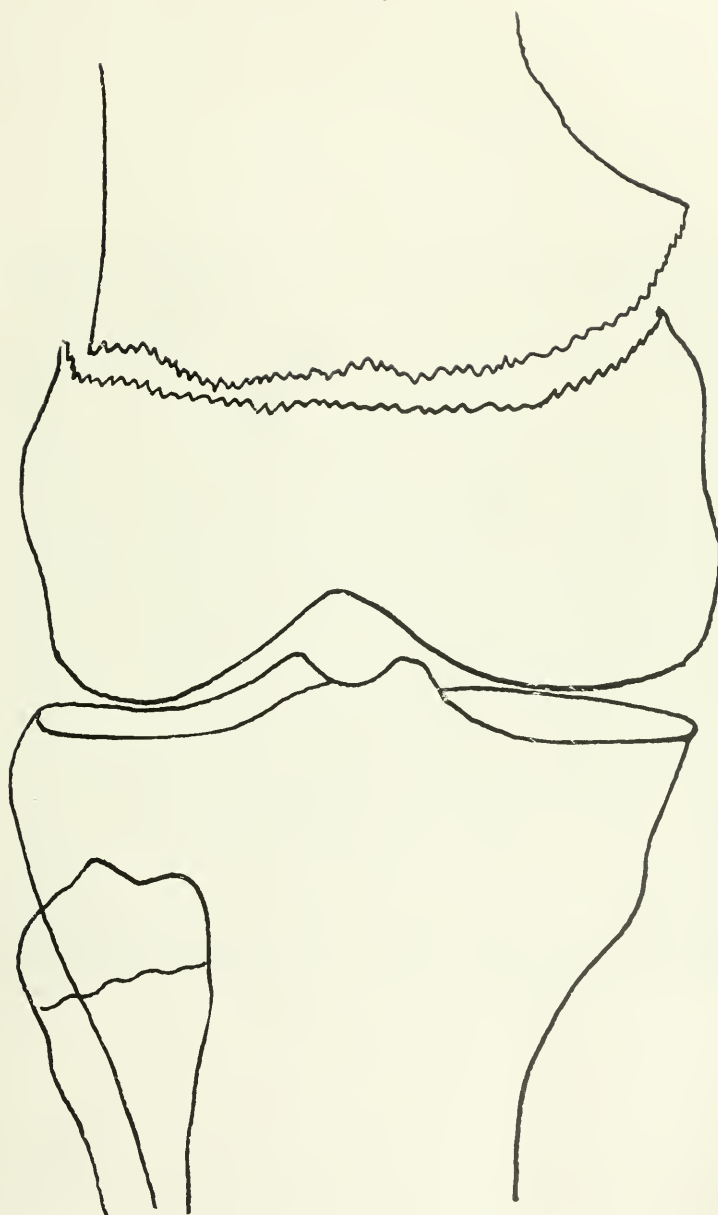
to the floor. He experienced great pain in the knee-joint but was able to walk to the hospital. Physical examination revealed a somewhat enlarged thickened joint but gave no positive evidence of fracture. A skiagram revealed a tearing off of the tibial spines (sketch 3).

CASE IV (from the service of Dr. Jos. Ransohoff).—Mr. J. D. while attempting to alight from a moving street car, twisted his left knee and was thrown violently to the ground. He was unable to arise, owing to the great pain in his knee. Physical examination showed *no bruising of the soft parts* nor evidence of fracture. A skiagram showed a tearing off of the internal condyle of the femur and an avulsion of the tibial spine (sketch 4).

In the above-cited four cases of fracture about the knee we have a history of a sudden and severe strain to the knee-joint with, upon physical examination, no evidence or bruising of the soft parts nor any of the usual signs of fracture. In Case I we may assume a lateral strain upon the knee from within outward, putting the *external* lateral ligament on the stretch, and then causing a tearing off of its tibial attachment (the *external* tuberosity of the tibia). In Case II we may assume strain in the opposite direction, which was exerted chiefly upon the *internal* lateral ligament, resulting in a tearing off of its tibial attachment (the *internal* tuberosity of the tibia) and also loosening a small fragment at the site of its femoral attachment (the internal condyle of the femur). In Case III the strain was borne chiefly by the crucial ligaments, resulting in an avulsion of the tibial spines at their base. In Case IV the strain was apparently felt first by the internal lateral ligament, which resulted in a tearing off of its femoral attachment (the internal condyle of the femur). This giving way of the internal lateral ligament apparently put the crucial ligaments on the stretch as evidenced by the avulsion of their tibial attachment (the tibial spine).

In studying the effect of knee strain by experimenting upon the cadaver, still another type of fracture by indirect trauma was brought to light. Figure 5, sketch 5, shows the result of lateral and postero-anterior strain upon the knee of

FIG. 5.



Epiphyseal separation at lower end of femur. Outline from a skiagraph (Fig. 6).

FIG. 6.



Skiagraph of epiphyseal avulsion at lower end of femur.

the cadaver of a young adult. It consists in a complete epiphyseal separation of the lower end of the femur. It was produced by placing the cadaver in a ventrolateral position and bending the knee over the edge of the table.

It is more than probable that such a fracture may be produced in the living in an analogous manner.

The close relation between the crucial ligaments and semilunar cartilages (anterior crucial with internal semilunar and posterior crucial with external semilunar) indicates that strains upon the crucial ligaments will be felt by the semilunar cartilages and that dislocations of the semilunar cartilages may be accompanied by strain-fractures of the above-described type and vice versa.

Routine Röntgen examination of injured knee-joints will undoubtedly show strain-fractures of the component bones to be relatively frequent. The well-executed skiagram will render possible an accurate diagnosis of conditions that are too often vaguely termed "internal derangements of the knee-joint."

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

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*(Stated Meeting, February 26, 1908.)*

The President, DR. JOSEPH A. BLAKE, in the Chair.

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## TRAUMATIC EPIDURAL AND INTRACEREBRAL HEMORRHAGE.

DR. BERN B. GALLAUDET presented a young man who was admitted to Bellevue Hospital, November 27, 1907, with the history of having received a blow on the left side of the head the day before. He was not continuously unconscious, but almost immediately became aphasic. On admission to the hospital, about fourteen hours after having received his injury, he was aphasic and showed right-sided paralysis of the arm and face. An operation revealed a stellate fracture of the skull, with extra- and subdural hemorrhage, as well as hemorrhage into the brain cortex over the area indicated by the symptoms. The patient left the hospital a month after the operation, showing satisfactory improvement. There was still some facial paralysis, but he was now able to move the arm. His aphasia had also gradually disappeared, although he still hesitated in his speech.

## OSTEOPLASTIC CLOSURE OF SKULL DEFECT.

DR. CLARENCE A. McWILLIAMS presented a woman, 26 years of age, upon whom he had performed an osteoplastic operation for the covering of a skull-defect following a compound depressed fracture of the vault of the cranium, complicated by laceration and abscess of the brain. The patient was brought to the Presbyterian Hospital by the ambulance on May 6, 1907, and was admitted to the service of Dr. McCosh, to whom Dr. McWilliams was indebted for the privilege of operating upon the case. She had been struck by a trolley-car, and when found was unconscious, pulseless and bleeding from the nose and from a

compound comminuted depressed fracture of the left frontal region of the skull. From this large wound, cerebral tissue was oozing freely. The anterior extremity of the scalp wound was situated at the beginning of the hair-line in the left frontal region, and ran backwards about four inches, and from it several fragments of bone protruded. The patient was in coma; the pupils were equal and reacted to light; there was no subconjunctival hemorrhage; a partial paralysis of the right arm and leg could be made out; there was bleeding from both nostrils, but none from the ears, and there were some ecchymotic spots under the skin of the left mastoid bone. The knee-jerk was absent on the right side, but present on the left. Babinski reflex present on both sides. Death was considered certain in a short time. However, under energetic stimulation, the pulse became just perceptible in six hours. The wound was cleaned and several fragments of bone removed. Her condition remained so serious that it was 36 hours before it was deemed advisable to transfer her from the accident room to the hospital ward. The patient remained unconscious for about two weeks, during which time she was fed by gavage. The urine and feces were passed involuntarily; the catheter being passed several times indicated that the bladder remained empty. The wound suppurated, and on enlarging it a collection of two ounces of pus was evacuated from a cavity in the cerebrum. There was a marked tendency for the brain to protrude, with sloughing off of fragments of it. Three and a half weeks later, the patient was just able to say a few intelligent words, but she was stupid and somnolent. The right arm and leg were still partially paralyzed. Urine and feces are still passed involuntarily. A fragment of bone, one by one and a half inches long, was removed from the wound, and a second larger fragment was felt to be movable but somewhat attached. The wound was granulating, and there was a granulating area of exposed brain tissue,  $1\frac{1}{2}$  in. wide and 4 in. long, spindle-shaped, with the long axis anteroposterior. Paralysis of the arm and leg remained the same.

On June 30, 55 days after the accident, the patient had been up and about for ten days. The function in the right arm and leg was returning. There was no facial paralysis. The bladder and rectum were functioning normally. Cerebration was very poor, the patient seeming unable to say connected sentences,

although there was no motor paralysis of speech. Her memory was badly impaired.

On July 9th, 64 days after the accident, she left the hospital to return for regular dressings for the granulating skull cavity. She had almost entirely recovered from the paralysis of the arm and leg.

Four months later, the process of granulation of the wound seemed almost at a standstill. The epidermis had crept in at the edges, so that the bones were covered over and the skin was attached to the cerebrum. At the bottom of the cavity was the pulsating cerebrum which was covered by granulating tissue, and which, by reason of its loss of tissue, was depressed about one half inch from the internal surface of the bones. She was re-admitted on November 4, 1907, to have the defect closed. This was deemed possible only by turning in a flap from the sides, since it was thought that if any foreign substance was placed in the wound, it would have to be removed later because of the granulating surface of the cerebrum. It seemed certain that the dura over the cerebral wound had sloughed away. The operation was conducted as follows: A piece of rubber tissue was placed over the defect, and a pattern cut out of it of the cavity, but one half inch larger than the same all around. This pattern was then laid on the skin to the right of the edge of the cavity, and an incision was made along the edge of the rubber tissue down to the bone through the periosteum, but leaving a pedicle of about an inch posteriorly. A chisel was then inserted along the incision line, the object being to chisel out a piece of the external table corresponding to the flap, and to raise it attached to the periosteum and skin. It was found that it was impossible to raise the bone in one piece, but that it broke in several places. However, the flap was finally turned in, so that the defect was entirely covered, there being on its under surface, several pieces of thin bone. The cicatricial edges of the defect were cut away, and the edges of the reflected flap were sutured to the edges of the skin of the defect, a small place being left posteriorly for drainage. The bare bone left by the removal of the flap was covered by some Thiersch skin grafts, taken from the thigh of the patient.

The wound healed very kindly, and the result is shown in the accompanying photograph (Fig. 1). There is some sinking in

FIG. 1.



Showing result after operation for osteoplastic closure of skull-defect.



of the flap, due to the loss of cerebrum beneath. It feels quite firm, indicating that there is a bony foundation to the flap.

#### FRACTURED SKULL, WITH EXTRADURAL HEMORRHAGE.

DR. JOSEPH A. BLAKE presented a female infant, three weeks old, colored, who was brought to Roosevelt Hospital three days after birth (forceps delivery) with a history of convulsions since that time, and a right-sided facial paralysis. The latter was complete, involving the entire distribution of the nerve, and probably peripheral, while the convulsions were apparently due to some injury of the brain or its membranes. During one of the convulsions observed at the hospital the mouth was drawn to the left, the right eye was tightly closed, and the right hand and arm were drawn up. Subsequently, she had three convulsions that night and several the next day, all involving the same region.

There was a hæmatoma of considerable size over the left temporal region, and upon exposing the skull, a curved linear fracture was discovered, corresponding closely in situation to the squamous suture. Upon elevating the bone, several small clots were found underneath; these were removed, and the bone flap replaced. The child's general condition improved markedly after the operation, and she has had no definite convulsion since. There was at first an occasional slight twitching of the hand, but this disappeared after three or four days. There were still some evidences of her facial palsy.

#### CEREBRAL INJURY DUE TO A DEPRESSED FRACTURE OF THE SKULL IN AN INFANT.

DR. GEORGE E. BREWER presented a girl nine months old, who was admitted to the Roosevelt Hospital on January 2, 1908. Six days before admission she had sustained a severe injury to the left side of the skull by a fall from her mother's arms. When picked up the child was apparently dead, and it was some time before the respiratory movements were reëstablished. Later it was noticed that the child did not move the right side of the body. She was kept at home under medical observation for six days. At the end of that time she was brought to the Roosevelt Hospital.

On admission the temperature was  $101.5^{\circ}$ ; pulse 128. The child was apparently conscious, took and retained nourishment

in abundance, and was not particularly restless. The right arm and leg were scarcely moved at all, while the left extremities appeared normal. There was a conjugate deviation of the eyes to the right, there was slight left facial palsy, the pupils were apparently equal and reaction normal. Examination of the head revealed an oblong swelling extending transversely across the mid-parietal region. This swelling was moderately elastic, and at the upper edge the bone could be felt distinctly depressed. On the advice of a neurologist the case was kept under observation for ten days, in the hope that the symptoms might subside without operation. On January 11th however, the condition being practically the same, the child was prepared for operation and a curved incision made over the left parietal region including the swollen area of the scalp. On lifting the omega-shaped flap of skin and soft tissues, there appeared to be a longitudinal fissure extending over a distance of nearly three inches across the centre of the parietal bone, which was joined near its anterior extremity by one extending upward toward the sagittal suture. The skull in the region of the longitudinal fissure was markedly depressed, and along the line of fracture there appeared a sausage-shaped mass of necrotic tissue about two and a half inches in length, and about three quarters of an inch in diameter. This mass appeared to be made up of dura and cerebral cortex, which had evidently been caught up by the depressed fragments at the moment of their greatest depression, and had been brought outside the skull by the spontaneous movement of the fragments towards their normal position. The upper fragment of bone which was most displaced, and which apparently caused marked cortical pressure was removed by bone forceps, also the depressed portion of the lower fragment. This exposed quite an area of the cortex, which was roughened and covered with a fibrinous exudate so that the shape of the convolutions could not be seen. The external necrotic mass was connected with the cerebral cortex by a flattened pedicle, which had occupied the fissure between the two depressed fragments. This was entirely removed, and as the condition of the patient was quite critical the operation was hastily terminated by replacing the cutaneous flap, and fastening it with two or three silkworm gut sutures. While this was being done, the child passed into a condition of complete collapse, pulse imperceptible, respirations entirely suspended. She was placed

in an inverted position, artificial respiration was undertaken, and the bowel partly filled with a hot salt solution. As a result of these stimulating measures, the child slowly rallied. An aseptic dressing was applied to the wound, and the child returned to the ward with a pulse of 160. Following the operation there was a sharp rise of temperature to 102° which however soon fell to the normal. The convalescence was uninterrupted, and she was discharged from the hospital ten days from the day of her operation. It is now twenty-five days since her discharge from the hospital. She appears in perfect health, and there is no apparent limitation of the movements of the arm and leg, the eyes are normal, and there is no evidence of facial palsy. The presence of a slight left-sided facial palsy, and the drawing of the eyes toward the right, would suggest some right-sided lesion. As it is quite evident that the depression of the fragments which occurred at the time of the injury must have been very great to have caught up such a large mass of cerebral tissue, it is easy to understand how such an injury might, by forcing the cranial contents violently toward the right, have caused some cortical lesion over the right motor area.

#### THE QUESTION OF OPERATION FOR NON-PENETRATING INTRACRANIAL TRAUMA.

DR. JOHN A. HARTWELL read a paper with the above title, for which see page 25.

DR. KILIANI said that in 1891 he reported a case of subdural hæmatoma with a free interval of 21 days. The man had received a blow on the head from which he apparently suffered no ill effects, but 21 days later his right arm became paralyzed. He was operated on on the twenty-fourth day after the receipt of the injury, and a subdural hæmatoma was found in the left motor area. Recovery was uneventful.

DR. McCOSH said there was one point upon which sufficient stress had perhaps not been laid, and that was, the danger of future epilepsy after comparatively slight injuries to the head, and in cases where the early symptoms were perhaps trifling or even entirely absent. He always instructed his house surgeon, in dealing with cases of head injury in which there was any hæmatoma or any focal symptoms, to lay open the scalp and carefully examine the skull for evidence of fracture. The speaker

said he had learned from experience never to give a fatal prognosis in a case of fracture of the skull; he considered it a very unwise thing to do. The case shown by Dr. McWilliams, when it entered the hospital, was apparently a hopeless one, and yet the woman had recovered.

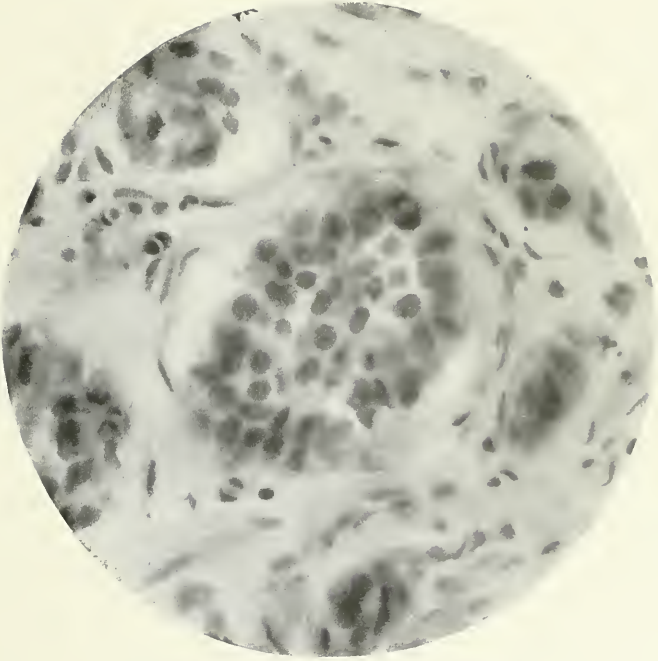
PRIMARY CANCER OF THE APPENDIX: NO RECURRENCE  
AFTER NINE YEARS.

DR. ANDREW J. McCOSH presented a man, 34 years old, who was admitted to the Presbyterian Hospital on April 7, 1897. He stated that his difficulty began in the previous August, when he had sudden cramp-like pains in the right lower abdomen, accompanied by vomiting. These persisted about two weeks. During the following month he had a similar attack, lasting three weeks. He then remained well until the following March, when he was seized with sudden tenderness and pain in the right iliac fossa, with abdominal distention and vomiting. He was just recovering from this attack on his admission to the hospital, and an examination showed rigidity and tenderness in the right iliac fossa.

An indefinite mass was felt in the cæcal region. Upon operation no fluid was found in the abdomen. Just to the outer side of the right sacro-iliac there was a semi-elastic non-pulsating mass three and a half inches in diameter and an inch and a half in depth. It involved the cæcum and appendix synchronously, and extended apparently behind the posterior peritoneum. It was somewhat boggy to the touch, and an aspirating needle was introduced into it with negative results. It was regarded as a malignant tumor, involving the cæcum, appendix and peritoneum. Its removal was deemed impossible, and the wound was closed with drainage. The patient made a good operative recovery and left the hospital in good condition.

He was re-admitted on January 4, 1899, twenty months after his first operation, with the following history: For the past eight months he had had attacks of cramp-like pain in the region of the old scar. These attacks had latterly become more frequent. He had lost no flesh nor strength; there was no history of jaundice and the bowels were regular. There was a ventral hernia in the old appendix scar. Upon palpating through this scar there was felt at the usual site of the appendix a hard mass, about the

FIG. 2.



Spheroidal-celled cancer of the appendix. The muscular coats are arranged in a circular and longitudinal group, and scattered irregularly between the muscle bundles are alveoli filled with irregular ovoid or polyhedral cells with large nuclei. In other portions there is a diffuse infiltration of the muscle tissue with similar cells. There are no mitoses visible in the cells.



size of a hen's egg. Upon operation, which was done on January 10, 1899, the intestines and omentum were found to be firmly matted together. Several large hard masses were felt in the posterior part of the abdomen, which proved to be enlarged retroperitoneal glands. The glands throughout the mesentery were also enlarged and hard. The appendix was separated from the adherent intestines with much difficulty. It was short and much thickened, and resembling an old chronic appendicitis. It was removed, and the wound closed with drainage.

A pathological examination of the specimen (Fig. 2), made by Dr. John S. Thatcher, showed typical adenocancer in some of the sections. A subsequent pathological examination was made by Dr. F. C. Wood, who pronounced it a spheroidal-celled carcinoma of the appendix vermiformis. Examination of the enlarged glands at the time of the operation showed them to be uninvolved by cancer. The patient now 9 years after the removal of his appendix enjoys perfect health, and there is no evidences of a recurrence. He has gained weight. There is a hernia at the site of the scar which gives him no annoyance. Dr. McCosh had operated on another case of cancer of the appendix. At the end of a year he was well, but since that time search for him has been in vain.

DR. OTTO G. T. KILIANI said he had seen two cases of primary carcinoma of the appendix. One was operated on five years ago; and when the speaker lost sight of him, about eight months ago, there were no signs of a recurrence, and the patient was in good health. The other was operated on about a year ago and was lost sight of. Both were adenocarcinomata.

#### PERFORATED ULCER OF THE DUODENUM.

DR. JOS. A. BLAKE presented a man, 43 years old, a horse-shoer, who was admitted to Roosevelt Hospital on December 13, 1907.

For one year he had had gnawing pain in, above, and to the right of the umbilicus, occurring in attacks which had gradually increased in length and severity so that for four weeks before admission he had given up his work. The pain was somewhat relieved by the ingestion of food and by vomiting. He had never vomited blood, but for two months the stools had been tarry. He had lost weight.

The abdomen was somewhat scaphoid, symmetrical. There was a sensitive point above and to the right of the umbilicus. No mass was made out. Gastric analysis showed hyperchlorhydria.

At operation a mass was found between the first portion of the duodenum and the pancreas. The pylorus was not stenosed but was fixed to the mass on its deep surface. The mass did not appear to be carcinomatous, but on account of the lack of stenosis, the efficacy of a simple gastro-enterostomy seemed questionable and a pylorectomy was decided upon. This accordingly was done, but with the greatest difficulty for it was found that the lesion was a large ulcer which had perforated the first portion of the duodenum into the head of the pancreas. In separating the structures, the entire pancreatic wall of the first portion of the duodenum seemed to be deficient. Closure of the duodenal stump was well-nigh impossible but was finally accomplished by turning its lateral wall over and sewing it to the pancreas. So much time had been occupied by the operation that a button anastomosis was made. After the operation, there was considerable hemorrhage into the stomach owing to faulty hæmostasis, but with this exception recovery was smooth. A large drain of gauze and rubber dam was inserted to the duodenal stump and left in situ for ten days, leaving a large sinus which closed slowly. There was not, however, any leakage from the duodenum. He is now back at work without gastric symptoms and is gaining flesh.

PERFORATED GASTRIC ULCER: DIFFUSE PERITONITIS:  
PERITONEAL LAVAGE: CLOSURE WITHOUT DRAINAGE.

DR. JOS. A. BLAKE presented a man, 45 years old, a publisher, who was admitted to the Roosevelt Hospital on February 12, 1908. Four hours before admission he had had a severe attack of pain while hanging up his coat. He immediately collapsed and suffered agony until relieved by two hypodermics of  $\frac{1}{4}$  gr. each of morphine. He had suffered from indigestion for five or six years.

On admission his abdomen was scaphoid and extremely rigid. There was diffuse tenderness most marked on the right side. Liver dulness was absent.

Operation six hours after the perforation revealed an opening 4 millimetres in diameter situated immediately at the pylorus

on its anterior surface. The gastric contents were escaping. The peritoneum everywhere in sight was injected and appeared swollen. The abdomen contained considerable quantity of gummy mucoid fluid.

The perforation was partially closed by a purse-string suture, but the suture could not be made secure until the duodenum had been folded over on the stomach, thus almost completely closing the already stenotic pylorus. The peritoneal cavity was then thoroughly washed out with a two-way irrigator, dirty fluid being returned from all parts of the abdomen. A posterior no loop gastro-enterostomy was then done by suture and the abdominal wound completely closed without drainage. Time of operation was fifty minutes.

The pulse came down a few beats as a result of the operation and he was returned to bed in good condition. His highest temperature,  $101^{\circ}$ , was reached on the third day and became normal on the fifth day.

Albumin water was given on the day after operation and on the third day he was given whole milk that had been coagulated with rennet, and the curd then beaten with an egg beater and pressed through cheese-cloth, there then being no possibility of large curds forming in the stomach. This form of milk, devised by Dr. Walton Martin, has been used with great success in several postoperative stomach cases and is far more palatable than peptonized milk.

#### PERFORATING GASTRIC ULCER.

DR. JOS. A. BLAKE reported this case, and showed the specimen. The patient was a housemaid, 21 years old, who was admitted to the Roosevelt Hospital on December 6, 1907. For six months she had pain rather characteristic of gastric ulcer, accompanied by vomiting. The vomitus had contained food and mucus, but not blood. She had lost between ten and fifteen pounds. Five weeks before admission she had noticed a small lump situated in the middle line of the abdomen above the umbilicus. This had grown steadily in size and had become tender. Upon examination, a hard tender mass, the size of a quarter, was found at the linea alba, one and one-half inches above the umbilicus. It was fixed, and apparently was partly superficial to and partly beneath the recti muscles.

The stomach analysis showed an increase in free hydrochloric acid.

At operation, the mass was found to consist of a dense zone of reparative tissue thrown about a perforating gastric ulcer. The ulcer, one centimetre in diameter, had perforated not only the wall of the stomach, but the linea alba, its floor consisting of the new connective tissue felt beneath the skin. The ulcer thus formed a sort of tube two centimetres in depth, surrounded by a dense wall of fibrous tissue, one centimetre in thickness. There were no adhesions beyond this wall. The ulcer was situated in the anterior wall of the stomach, close to the lesser curvature, five centimetres from the pylorus. It was excised, the lines of excision crossing the lesser curvature and extending into the posterior surface of the stomach. After excision, the opening in the stomach was closed by an inner continuous suture of chromicized gut and a Cushing suture of silk. No further treatment was carried out, as the pylorus was open. Recovery has been uneventful and free from symptoms of ulcer.

DR. HOTCHKISS enquired whether Dr. Blake had noticed in these cases of operation upon the stomach, a tendency to non-union in the abdominal wound. He had had this experience recently in a case of perforated gastric ulcer in a very emaciated man where at the end of about a week the abdominal wound had burst open and this apparently was more from lack of reparative power than infection.

DR. MCCOSH said he could recall two or three instances where after stomach operations on semi-moribund patients, the sutures failed to hold, simply pulling through the tissues, and this without the slightest evidence of infection of the wound. When at the end of 10 or 12 days the silk sutures were removed there was an almost complete lack of repair and the wound edges fell apart. As well as he could remember operation in these cases had been done for cancer.

DR. BLAKE thought the point brought up by Dr. Hotchkiss was a very important one. He had noticed this absence of reparative power particularly in cancer of the stomach, since starvation was associated with cachexia. Under such conditions, it was now his practice to use a non-absorbable suture material.

DR. KILIANI said that in his cases of cancer of the stomach he employed very heavy suture through and through material of

silk; for closing the abdominal wound he had found that other sutures were liable to tear out.

#### TYPHOID PERFORATION OF THE ILEUM.

DR. WALTON MARTIN presented a woman, 42 years old, who was operated upon by him on November 6, 1907, at the Roosevelt Hospital in the service of Dr. Blake, for intestinal perforation.

The patient was admitted to the medical service on November 4th. Her statements were confused, and it was difficult to obtain a satisfactory history. Apparently, she had been ill for three or four weeks, having chills and fever and feeling prostrated and sick, but she was able during this period to do a little housework.

Three days before admission to the hospital, although feeling very weak, she attempted to cook dinner for her family, but while doing so, was seized with such severe cramp-like pains in the lower abdomen that she had to go to bed. Shortly afterwards she began to vomit and to have a diarrhoea. During the next day she became worse, and finally, three days after the onset of the severe pain, she sent for an ambulance and was brought to the hospital. On admission, the temperature was  $100.8^{\circ}$ ; pulse 124; respirations, 32; leucocyte count, 6200; polymorphonuclear, 84 per cent.; lymphocyte, 16 per cent. The woman looked ill. Her entire abdomen was slightly distended. There was no rigidity. It was more tender in the upper than the lower half. Spleen not felt. Vaginal examination negative.

The following day she had a chill lasting twenty minutes, the temperature rose to  $104^{\circ}$ ; the pulse to 140. The leucocyte count was 7000, and polymorphonuclear 90 per cent. No malarial organisms were found in the blood.

The next morning her temperature had fallen to  $100^{\circ}$ ; her pulse was 120; slight rigidity and tenderness were now present over the lower abdomen. She was transferred to the surgical division, an immediate operation having been advised.

Operation one hour later. Abdomen opened through a right intermuscular incision with an extension through the sheath of the rectus. The appendix showed secondary appendicitis of outer coats. There was gas in the pelvis. The coils of intestine in the lower abdomen were very heavily coated with large flakes

of fibrin. The pus had the characteristic odor of colon bacillus pus. The mesenteric glands were markedly enlarged. On pulling up a piece of gut from the pelvis, there was a gush of fluid feces, that had evidently been bound in by adhesions about a small perforation in the small intestine, about  $\frac{3}{8}$  of an inch in diameter. It was punched out in appearance. The heavy flakes of fibrin over the intestine made it impossible to say whether the perforation was in a Peyer's patch. The tubes, ovaries and uterus were apparently normal. The appendix was removed in the usual manner. The perforation in the intestine was closed by a silk purse-string suture, reinforced with catgut Lembert sutures. The abdominal cavity was carefully washed with normal salt solution. A double drainage-tube was introduced to the bottom of the pelvis, and the abdominal wall closed about the tubes.

The temperature after operation was  $101^{\circ}$ ; pulse, 108. During the following night her temperature reached  $105^{\circ}$  and her pulse 140. A positive Widal reaction was present three days later, and about a week later one of her children, who had been living with her on a barge in the North River, was admitted to the hospital suffering from typhoid fever.

The patient made a slow recovery, her convalescence being interrupted by residual abscesses, one on the left side, one between the bladder and a coil of small intestine, and one in the axilla. In opening the median abscess the bladder was torn and although the tear was sutured, there was a leakage of urine for several weeks. She is now in good health and rapidly gaining weight.

The patient evidently had ambulatory typhoid, with a perforation of a coil of intestine situated in the pelvis. The operation was performed five days after the onset of the severe abdominal pain.

DR. L. W. HOTCHKISS said he had seen a case very similar to the one reported by Dr. Martin. The patient was brought into Bellevue Hospital with the history of an illness dating back for some time. Abdominal symptoms had developed a few days before. Upon operation, a large encapsulated pelvic abscess was found in connection with a perforation of the small intestine. There were no positive evidences of typhoid at the time, but the perforation was probably due to a typhoid ulcer. Resection of the gut was done. The case resulted fatally.

DR. BLAKE referred to a case presented by him at a previous meeting in which the typhoidal perforation was of three days' standing at the time of operation. In that case there was first a pelvic peritonitis which at the time of the operation had become general.

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*Stated Meeting, March 11, 1908.*

The President, DR. JOSEPH A. BLAKE, in the Chair.

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#### GASTRIC ULCER.

DR. ALEXANDER B. JOHNSON presented a woman, 47 years old, who was operated on by him in 1899 for carcinoma of the left breast. The tumor was small, occupying the upper and outer quadrant of the breast, and there was no axillary involvement. Nine years had elapsed since the operation, and there were no signs of a recurrence up to the present time. About two and a half years ago the woman began to suffer from gastric disturbance. She did not vomit, but there was a continuous gnawing pain in the epigastrium. The gastric motility was not noticeably impaired, and there were no evidences of dilatation. An analysis of the stomach contents showed hyperacidity. Although there was no history of hæmatemesis, it was thought that she probably had an ulcer of the stomach. The patient had lost much flesh, and the pain was so severe that her sleep was disturbed.

Upon exposing the stomach, in April, 1907, an indurated area was found in its wall, about midway between the pylorus and the cardiac end, in the region of the greater curvature. This area of induration was oval in shape, measuring three inches in one diameter and two and a half inches in the other. There was a notable amount of fibrinous peritonitis which had caused the stomach to adhere to the neighboring intestines and abdominal wall. Near the center of this indurated adherent area there was an ulcer of the stomach, which was just about to perforate. The mesenteric glands were more or less enlarged. The entire involved area was excised, and the wound was closed. The patient made a good convalescence, and there had been no return of her acute symptoms, although the hyperacidity continued and she still had a certain amount of gastric dyspepsia. At the time of opera-

tion, the stomach was not found to be dilated, and there were no evidences of pyloric stenosis.

The pathological diagnosis was chronic ulcer of the stomach. Around the ulcerated area, which was the size of a twenty-five cent silver piece, was a large area in which the mucosa and muscular wall of the stomach had been replaced by cicatricial tissue. There was no evidence of malignancy.

#### GASTRO-ENTEROSTOMY.

DR. ALEXANDER B. JOHNSON presented a man, 43 years old, who was admitted to the New York Hospital on December 16, 1907, with the following history: Eighteen months ago he had first noticed belching of gas, bloating of the stomach, and vomiting of watery, sour fluid. He also complained of pain after eating, and a burning sensation located under the sternum and radiating to the sides of chest and shoulder. This was relieved by vomiting. Shortly after his initial gastric symptoms he had an attack of severe gastric pain. He was taken to the House of Relief, where the diagnosis of perforated gastric ulcer was made and confirmed at an operation which was done by Dr. Tilton. Six weeks later the patient left the hospital, and remained well for three months, when his original symptoms returned.

Upon his admission to the New York Hospital he complained of pain in the epigastrium, with vomiting and loss of weight and appetite. An examination of the stomach contents after an Ewald test meal showed a total acidity of 87 per cent., with 38 per cent. of free hydrochloric acid; there were marked traces of blood and lactic acid; starch digestion was poor. To the right of the middle line, and about three inches above the umbilicus a hard nodular mass was felt in the region of the pylorus. The stomach was markedly dilated, and gastric motility was much impaired. The case was regarded as one of stenosis of the pylorus from gastric ulcer, with much scar tissue in the pylorus, or of the same condition with secondary carcinomatous degeneration. Upon opening the abdomen the stomach was found markedly dilated. The pylorus itself and the stomach wall near the pylorus were hard and appeared to be extensively infiltrated with scar tissue. The appearances seemed to be the result of chronic ulceration rather than of malignant disease. A posterior gastro-enterostomy was done by the suture method and the short jejunal

loop. Fine chromic gut was used for the inner row of sutures, and Pagenstecher thread for the outer. Since the operation which was done on January 31, 1908, the patient had not vomited, he was on ordinary diet, and had had no gastric discomfort. He had gained thirty-one pounds in weight. He had resumed his work.

DR. BENJAMIN T. TILTON, who had done the original operation for perforated gastric ulcer in the case shown by Dr. Johnson, said the operation was done about six hours after the perforation had occurred. A small opening was found in the anterior stomach wall near the pylorus, and there were evidences of a beginning suppurative peritonitis. The operation consisted in simply excising the involved area and putting in a few inverting sutures. Subsequent to the operation, the man developed an attack of right lobar pneumonia, but otherwise made a good recovery.

#### APPENDICITIS: MISPLACED APPENDIX.

DR. JOHNSON presented a boy, 12 years old, who was admitted to the New York Hospital on January 26, 1908. The history obtained was that two days before admission he was seized with severe abdominal pain which was referred at first to the umbilical region. On the day prior to admission the pain became general and had progressively increased in intensity. The patient had vomited once; the bowels had moved to catharsis. He had moderate fever and leucocytosis, with a relative increase of the polynuclear cells.

Upon examination, the lower half of the abdomen was found to be quite rigid, the tenderness not being more marked on one side than the other. The symptoms seemed to point to the appendix, although the tenderness was perhaps most marked just below the umbilicus. The case was regarded as one of perforative appendicitis, with abscess formation and a probably spreading peritonitis.

On making the usual abdominal incision, no cæcum nor ascending colon could be found, nor could the transverse colon be made out. The case was thereupon regarded as one of those rare instances of failure of rotation of the intestines during foetal life, and a left intermuscular abdominal incision was made. The small intestine was found to have a mesenteric attachment ending below at an unusually high point. The cæcum lay to the left

of the median line at the level of the body of the fourth lumbar vertebra. The ileum entered the cæcum from right to left. From the cæcum the colon extended upward to the cardia of the stomach and then downward in one or two irregular coils, with a very short sigmoid, into the rectum. The very long appendix extended downward to the bottom of the pelvis in front of the rectum crossing it from right to left. The tip of the appendix was gangrenous and perforated. It lay in an abscess of moderate size surrounded by an area of fibrinous peritonitis. The appendix was removed in the usual way. The child made a good convalescence from the operation but on account of the great depth of the abscess a small sinus, now only one inch deep remained.

DR. GEORGE E. BREWER said that about a year ago he saw a case very similar to the one presented by Dr. Johnson. The patient was admitted to the Roosevelt Hospital with symptoms of an acute abdominal inflammation, the whole lower abdomen being more or less rigid, but the symptoms being slightly more marked on the right side. When the abdomen was opened through a Kammerer incision the speaker said he was surprised to find only small intestine on the right side. Thinking this was due to an incomplete descent of the cæcum, he extended his incision upwards, but found nothing suggesting large intestine. Upon retracting the incision towards the median line he discovered the colon, and further investigation showed a perforated misplaced appendix.

DR. JOSEPH A. BLAKE said he had seen two cases like those described by Drs. Johnson and Brewer, and he thought the diagnosis could best be made by carrying the exploration up to the duodenum. The cæcum could only be brought over to the right side by rotation of the gut, and when this failed to occur the mesentery was straight, and the cæcum remained in the median line. With incomplete rotation we would find the cæcum in close relation to the liver.

STAB WOUND OF HEART; SUTURE; DOUBLE LOBAR PNEUMONIA; EMPHYSEMA; THORACOTOMY; DRAINAGE.

DR. JOSEPH A. BLAKE presented a negro, 24 years old, who was admitted to the Roosevelt Hospital on December 13, 1907.

While drunk, about two hours before admission, he had been stabbed in the chest. He at first took little notice of the injury

and walked a block, when he had to sit down on the curb on account of weakness. He was found by the ambulance surgeon in good condition but, on arriving at the hospital, became rapidly worse.

On admission, a stab wound, 2 cm. long, was found over the fourth costal cartilage, a cm. within the nipple line. The wound was bleeding moderately, and occasionally bubbles escaped. The area of cardiac dulness was increased. The heart sounds were inaudible; the radial pulse was barely perceptible and was irregular in force and rhythm.

A diagnosis of wound of the heart was made by Dr. Dwight, the house surgeon, and Dr. Blake was summoned immediately, reaching the hospital by the time things were prepared for operating.

The operation was performed under drop ether anæsthesia, about two and one-half hours from the reception of the injury. On account of the implication of the pleura, made evident by the bubbles escaping from the wound and the signs of fluid and air in the chest, he decided to open the pleural cavity; therefore, a rectangular flap was cut, embracing the third, fourth and fifth costal cartilages, and turned over the sternum, the cartilages being cut at the ribs and broken at their sternal attachments. The fourth costal cartilage was found to have been already divided. The pleural cavity was thus widely opened, disclosing a wound somewhat over a cm. long in the pericardium, from which blood was flowing. The pericardium was then opened parallel to its attachment for a distance of 6 cm. It contained about two ounces of clotted blood. Close to the anterior coronary artery there was a wound in the right ventricle, one cm. long, from which a small fountain of dark blood played for a distance of 10 or 12 cm. at each systole. The hemorrhage was easily controlled by gentle pressure. The wound was closed with three interrupted sutures of fine silk, passing through the entire thickness of the ventricular wall, and there still being a little oozing, a Halsted mattress suture was placed over them. The sutures were introduced with some difficulty owing to the propinquity of the coronary artery but, by grasping the heart fairly firmly in the left hand, its action was interrupted sufficiently to permit accurate insertion. The blood was then washed from the peri-

cardium and the opening in it sutured. The blood in the pericardium was clotted, but that in the pleura was fluid and amounted to about two pints. This was removed by sponging, and the flap was turned back, the wound being closed without drainage, excepting a piece of tape introduced into the stab wound, which communicated with the deep portion of the operation wound. The costal cartilages were sutured with chromicized catgut. There was no injury to the lung.

The pulse was steady after the operation, averaging 108, and was of good force. The temperature was subnormal, 96°. This was followed by a reaction to 101°. The next day the temperature averaged 104°; the pulse varied from 112 to 136, the respirations from 28 to 64. Signs of consolidation of the lower lobes of both lungs appeared, the temperature during the following week ranging between 102° and 105°. The operation wound healed by first intention, but the stab wound became grayish and sloughing. After the tenth day, the temperature ran lower, but was of the septic type, and pus discharged from the wound, the operation wound being partially opened to increase drainage. The heart's action was extremely good during all this period.

The pleural cavity, however, drained imperfectly through the anterior incision, and on the twenty-sixth day a portion of the ninth rib in the scapular line was removed, and a drainage tube inserted. This was followed by immediate improvement, and the lung gradually expanded, the sinuses finally closing. He was discharged on the fifty-ninth day in good general condition.

At present, three months after the injury, he was in good condition, although he felt the effect of the prolonged sepsis. The heart's action was regular; there was a friction sound. The wounds were completely healed.

#### REDUCTION OF FRACTURE-DISLOCATION OF SPINE AFTER LAMINECTOMY.

DR. CLARENCE A. McWILLIAMS presented a man, 34 years old, who was admitted to the Presbyterian Hospital on September 4, 1906, at 8 P.M. The history obtained was that at 1 o'clock that afternoon, while bending over and hammering some nails into a board, he was struck in the middle of the back by a heavy pile, which knocked him flat. He was unable to move afterwards,

and was brought from the Port Chester Hospital on an air mattress lying flat on his face.

Examination showed an extensive swelling, the size of a large saucer, over the lower dorsal and lumbar region. It was evidently a hæmatoma, but under this was felt an irregular mass between the spinous processes of the twelfth dorsal and first lumbar vertebræ. The projection of the twelfth dorsal process was much more marked than that of the first lumbar. Palpation of the involved area was very painful, as was also any motion of it. There was a total loss of motion below the line of fracture. The soles of the feet were completely insensitive, and this extended up to the middle of the calves. Both popliteal spaces were somewhat hyperæsthetic, and pain and temperature sense was entirely absent over the back of both lower extremities. The plantar reflexes were absent. On the posterior thighs he could distinguish the prick of a pin from friction of the fingers, but he could not do so on the back of the calves. In the position occupied by the patient, no satisfactory examination of the anterior reflexes or sensations were possible. There was retention of urine, necessitating the use of catheter. No priapism.

The case was regarded as one of incomplete crushing of the cord, well suited for surgical intervention, and the patient was operated on at 11 P.M., ten hours after the receipt of the injury. A four-inch incision was made over the tenth, eleventh and twelfth dorsal and first lumbar vertebræ, and a large amount of subcutaneous effused blood escaped. The finger could now be passed directly down to the spinal cord, between the eleventh and twelfth dorsal vertebræ as the interspinous ligament was torn. The muscles were cut away from the laminæ, and the spinous processes and laminæ of the eleventh and twelfth dorsal and first lumbar were removed. Bleeding was easily controlled by packing. The articular process on the upper left side of the twelfth dorsal seemed to be empty and was directed inwards and upwards, while the lower articular surface of the eleventh dorsal was resting just in front and above the articular surface on the upper side of the twelfth. On the opposite side of this there was a fracture which extended through the eleventh and possibly the twelfth transverse processes, internal to the articular surfaces. Several small fragments of bone were removed. The dura seemed uninjured, but was arched over the projection caused by the body of

the twelfth dorsal vertebra. A hypodermic needle introduced through the dura brought clear fluid, without blood. The dura was not opened. The dislocation was reduced by traction of an assistant on the patient's left shoulder, and traction by a second assistant on the pelvis and thigh; at the same time the operator exerted pressure on the opposite right lumbar region, the object being to rotate the man's trunk so as to separate the articular processes, if possible. This was finally accomplished by prying the edge of the eleventh articular process upward by means of a periosteal elevator. When this was done, the left shoulder was twisted posteriorly, and the edge of the articular process on the under surface of the eleventh rode over the upper edge of the articular process on the upper surface of the twelfth. Great force was necessary to accomplish the reduction. The muscles were then sutured, and a rubber drainage tube inserted. The operation, which lasted one hour, was well borne by the patient. Two long padded splints were placed along either side of the vertebral column, and bound down by adhesive plaster. Two muslin jackets were then placed around him. These pads were left undisturbed for six days, and during that period his temperature never rose above 100. On the sixth day a plaster jacket was substituted, and after this had hardened the patient was turned over on his back. His wound healed by primary union. Catheterization was necessary for nine days, the procedure each time being followed by a boric acid bladder irrigation, and urotropin was administered by mouth. At no time were there any evidences of cystitis. On the ninth day urination became involuntary; this was not the overflow of retention, for a catheter introduced on several occasions withdrew no residual urine. By the end of the second week he became conscious of the desire to urinate, but he could not retain his water when the desire came. The same was true of defecation. Constipation was absolute for several months. A week after the operation he began to have lancinating pains down the legs, and on the thirteenth day he could barely twitch the three left outer toes. The sensations of touch and pain had extended downwards to include all the surfaces of both legs, excepting the plantar surfaces, but was much less acute on the right than on the left side. On the nineteenth day he could move all the left toes and could flex the leg very slightly. The right toes could only be twitched slightly. On the thirty-fifth day he began

to contract the left quadriceps; the leg could be well flexed and the movements in the left toes were vigorous. The right lower extremity showed much return of power, but he could move all the toes slightly and there was an intimation of contraction of the right quadriceps.

On October 30, 1906, fifty-two days after the injury, a neurological examination was made by Dr. J. Ramsay Hunt. At this time slight flexion of the right toes and hip was possible, while on the left side the improvement was more marked. There were indistinct flexion and extension movements in the toes, ankles and knees. On both sides, knee and ankle jerks were present and exaggerated. On the right side there was ankle clonus; none on the left. Babinski on right; none on left. Tactile sense was impaired over both lower extremities. Pain sense was much impaired over both extremities; also the temperature sense.

The patient continued to gradually improve, and sat up in a chair on November 17, 1906, seventy-four days after the operation. On the ninety-fifth day he began using a walking machine, and on the one hundred and fourth day was able to get around on crutches. He left the hospital on December 21st, one hundred and eight days after the operation. For three months longer he used two crutches, and then for two months he used one crutch, which he at that time discarded for a cane. Neurological examination by Dr. J. Ramsay Hunt, on September 12, 1907, one year after the operation. Still has occasional shooting pains below the knees but gradually diminishing in intensity. Vesical function shows a little retardation but no incontinence. Sexual desire impaired but erections occur. Station is good. Gait typically spastic, the right leg showing a greater involvement than the left. Ankle clonus on both sides and bilateral Babinski. Abdominal reflexes present, left cremasteric present but right absent. The superficial sensations of touch, pain and temperature are diminished below the knees. The deep sensibility of the toes is well preserved. Stands and walks perfectly well without assistance.

Note, April 2, 1908, one year and seven months after the operation. The patient is able to rise from a chair and stand and walk without any assistance whatever. There is good movement and fair strength in both lower extremities but the gait is still typically spastic and shows a slight improvement over the

previous examination above. Tactile sensibility is still diminished below the knees in both extremities. He asserts that his erections are growing stronger and that he is able to have coitus about once a month. His back is perfectly mobile in all directions and appears to have lost no strength. The right leg is stronger than the left but somewhat more spastic.

DR. GEORGE WOOLSEY, who had seen the patient shown by Dr. McWilliams prior to and at the operation, said it was very evident at the time that any reduction of the dislocation would have been difficult, if not impossible, without the open method. Even by this method reduction was not easy to accomplish, and the case was an illustration of the fact that in similar cases of fracture-dislocation of the spine where radical interference is indicated, the open method is far easier and safer than any external manipulations. Surgeons are not justified, of course, in operating on all cases, but when active treatment is indicated, operation is far better than manipulation.

#### NEPHRECTOMY FOR TUBERCULOSIS OF THE KIDNEY AND URETER.

DR. GEORGE D. STEWART presented a man, 39 years old, who three years ago first noticed that his urine was yellow, and looked as though it contained pus. Urinated six to ten times daily. Each urination was accompanied and followed by more or less smarting. On physician's advice took infusion Buchu; condition improved. Two years ago on return of same symptoms, he consulted a physician who treated him for nine months. About this time he first noticed pain in his left side. It was dull, persistent in character, most severe in bad weather. Each attack lasted about a day; thought it was rheumatism. He was cystoscoped and treated locally. However he became gradually worse. Began to lose weight. Had attacks of chills, fever, and sweats at intervals, four in the last six months. All of his other symptoms returned, except he states that the urine was clear, becoming, however, cloudy on standing.

October 21, 1907. He went home and urinated before retiring. Ten minutes later, he states that he passed a quart of urine; one hour later another quart. At this time he noticed a lump in his left side, which was not painful, was movable and

about the size of an orange. He went to St. Vincent's Dispensary the following day and was referred to the hospital.

*Physical examination* shows mass in the left lumbar region extending beyond median line. Above it disappears beneath costal margin, below extends into false pelvis, firm in consistency, not tender, movable with respiration, skin not involved fluctuation not elicited. Amount of urine in twenty-four hours was 60 ounces. Color, amber. Reaction, acid. Specific gravity, 10-10. Albumen, moderate trace. No sugar. Microscopic, few red cells, few pus cells.

*Operation*, October 26, 1907. Incision from angle between erector-spinae muscles and last rib, forward towards crest of ileum, then directly forward to outer edge of rectus abdominis. Mass exposed found to be adherent to peritoneum and intestines, particularly the transverse mesocolon. Tumor dissected from diaphragm. The adhesions were difficult to tear, and in separating them an abscess was opened and contents escaped into the open peritoneal cavity; not invading the latter to any extent, however, as it had been rather carefully walled off with pads. The pedicle was tied and cut and the *ureter*, which was manifestly involved in the tubercular process and about the size of a finger, was cut beyond the pelvic brim. Because of the size of the large mass, considerable quantity of gauze packing was placed in the wound. Skin was sutured and entirely closed except at posterior angle.

*Pathological Report* of Dr. Harlow Brooks. Microscopic examination of the greatly hypertrophied kidney removed shows practically the entire non-necrosed area to be made of a diffuse type of granulation tissue of low vitality, showing frequent areas of necrosis. Numerous tubercles are found scattered from place to place, but they are apparently of recent origin and seemingly younger than the accompanying simple inflammatory lesions. From this fact, one might surmise that the tubercular process was secondary.

*Subsequent History*.—Patient out of bed on twenty-first day; gained thirty pounds in two months; since operation has had no symptoms referable to kidneys, except that on two occasions he has had to rise during night to urinate. Examination of urine shows it to be normal with no evidence of tubercular bacilli. Recently the patient has had several small carbuncles on his back,

but they have not interfered with his general health or gradual increase in weight.

Patient is presented to show the good results of a not too radical operation for kidney tuberculosis. In this instance a certain amount of the ureter involved in the tubercular process was left behind, and yet the patient shows neither local nor constitutional symptoms. It would appear that the tendency in recent years not only in genito-urinary tuberculosis, but also in the surgery of tubercular glands, joints, etc., has been towards conservatism and the outcome in this case adds, it seems, its quota of evidence in favor of such a course.

#### BENIGN STRICTURE OF THE ŒSOPHAGUS; GASTROSTOMY; DILATATION BY THE STRING METHOD.

DR. GEORGE D. STEWART presented a man, 40 years old, who was admitted to Bellevue Hospital on February 20, 1907. His family and past history was negative.

About four months ago patient mistook a glass of washing soda for water, and drank some. Thinks he spat it all out at once, but not sure. Washed out mouth at once and drank water. For few hours after he had burning sensation at the level of the lower part of larynx. Ever since he has had pain in this region when he swallows also has had pain in epigastrium immediately after eating, and relief only after vomiting. Three weeks after taking the soda he began to vomit after eating. At first this was intermittent but increased in frequency. Sometimes the vomiting ceased for three or four days at a time. The vomitus was never large in amount, one to two cupsful at most; never sour; returned milk never clotted. No blood. Has lost 40 or 50 pounds.

February 27, 1907. On account of his extreme weakness a gastrostomy was performed according to the method of Senn.

Following his operation he gained 45 pounds in about six months. The gastrostomy was most efficient. Discharged September, 1907.

February 18, 1908. Patient was re-admitted to ward for the purpose of having his stricture treated. He had continued to gain in weight and was properly nourished. He also reported as being able to swallow a little water. An attempt was therefore made to get a string into his stomach by having the patient

swallow it, which was successful. The string after entering the stomach was washed out through the gastrostomy wound. With this fine string a larger silk one was drawn through the œsophagus. Then a bougie, about No. 28 French, was easily drawn through. Following this he was able to swallow, and since that time the bougies are being increased in size. The patient is now able to swallow perfectly, and has discontinued using his gastrostomy opening.

DR. BLAKE said that in cases where the string could be introduced into the stomach by swallowing, it could readily be recovered through the gastrostomy wound by first throwing some water into the stomach and then sucking it out through a tube or catheter. If the string could be swallowed without difficulty, it was scarcely necessary to keep it permanently *in situ*.

DR. F. KAMMERER said that by simply inserting a drainage tube through the gastrostomy wound of the patient in the erect position and instructing him to swallow water, the end of the string would come out through the tube. The speaker said that in tubular strictures, especially those of the cicatricial variety located near the lower end of the œsophagus, he had found that while dilatation with bougies was very simple to a certain degree, it was often impossible to dilate any farther, to a degree permitting easy deglutition. The stricture was very apt to become irritated and to re-contract. He had in mind one case where after cutting by the string method he had introduced bougies for eighteen months without accomplishing much more later on than had been accomplished almost immediately after the cutting operation.

DR. CHARLES N. DOWD said that he had obtained excellent results by following the suggestion of von Hacker in stretching out a piece of rubber tubing and drawing it into the stricture: the steady pressure of the rubber quickly dilated a soft stricture to the stage where ordinary bougies could be used through the mouth.

DR. KAMMERER said that he had tried the permanent rubber tube in the case he had just referred to, but it was not borne well by the patient, and apparently gave rise to irritation and fever. The ease or difficulty of dilating these strictures depended very much on the nature and size of the constriction.

INTERSTITIAL NEPHRITIS WITH MULTIPLE ABSCESS  
FORMATION.

DR. GEORGE WOOLSEY presented a woman, 28 years old, who was admitted to the Gynecological Service of Bellevue Hospital on January 6, 1908, complaining of headache, backache, nausea, pain in the abdomen, vaginal discharge and perineal weakness. She had a cystocele, a small rectocele, a retro-flexed uterus and a relaxed perineum. On January 14th Dr. Barrows did a perineorraphy and a double Alexander operation, and the patient was discharged on January 30 in good condition.

She was re-admitted to the Surgical Division on February 5 with the history that during the night prior to her admission she had had a chill, followed by fever and nausea, but no vomiting. She complained of a severe pain in the right hypochondriac and lumbar regions, and stated that she had some cough, with blood tinged sputum. She was poorly nourished, and the physical signs at the apex of the right lung indicated tubercular trouble. There was marked rigidity of the upper right rectus and in the right lumbar region. On palpation, a very tender mass was felt below the right costal margin. This moved slightly with respiration. Her temperature on admission was 104; pulse, 140; respirations, 32. Leucocyte count, 15,000. The urine contained a heavy trace of albumin and a marked trace of indican. No blood nor tubercle bacilli; no casts. The patient micturated from two to four times at night: there was no frequency during the day. A cystoscopic examination made by the Kelly method showed that there was no congestion about the mouths of the ureters nor of the bladder generally.

Operation, February 14, 1908. When the abdomen was opened through a small exploratory incision through the right rectus the right kidney was found to be much enlarged. The other organs were apparently normal. The kidney was then fully exposed through a lumbar incision. The fibrous capsule was very adherent to the fatty capsule, and the former was torn in freeing the kidney. The kidney showed numerous elevated areas of lighter color and various size, round and oval, and softer than the main portion of the organ. A nephrectomy was done, from which the patient made an uneventful recovery.

A pathological examination of the removed kidney showed it to be the seat of an acute interstitial nephritis, with multiple

abscess formation. Smears showed diplococci; no tubercle bacilli. Cultures gave a colon bacillus-like growth.

Since the operation, the patient's symptoms had improved, and the nocturnal frequency had diminished. The case was not regarded by the pathologist as one of infarct of the kidney, but as an acute interstitial process, with marked leucocytic infiltration, which was beginning to break down into small abscesses.

DR. GEORGE E. BREWER said the gross pathological appearance of the lesions in the specimen shown by Dr. Woolsey seemed to be of the same type as those described under the name of hemorrhagic infarcts. The speaker thought it was undoubtedly a blood infection. We could get a good many different microscopic appearances in these cases, which was explained by Albaran on the ground that in a kidney excreting bacteria from the blood, many different pathological conditions might occur. Primarily, however, they originated from a blood infection, and were due to the fact that the bacteria were carried into the arteries.

DR. BLAKE said he had seen quite a number of cases in which the appearance of the kidneys was typical of the specimen shown by Dr. Woolsey, and, like Dr. Brewer, he had always looked upon them as the result of an infection carried by the arteries. They also closely resembled the lesions found in early tuberculosis of the kidney. Here we had to deal with small multiple foci which later on might perhaps coalesce and form a condition resembling infarct.

#### EXCISION OF CARCINOMA OF THE RECTUM BY THE COMBINED METHOD.

DR. JOSEPH A. BLAKE read a paper with the above title for which see page 80.

DR. WOOLSEY said the combined method possessed one advantage which was perhaps not always sufficiently emphasized, namely, that it allowed the operator to learn the extent of the pelvic involvement in a way that could not be secured by the parasacral method. The speaker said that when he employed the latter method he was in favor of doing a preliminary colostomy, and in this way discovering the extent of the disease in the pelvis. With the combined method we could go right ahead and remove much more extensive growths, or determine whether they were operable or not.

DR. BLAKE, in closing, said that in none of his cases had he made an attempt to construct a competent abdominal anus other than bringing the end of the bowel through an ordinary McBurney intermuscular incision. He rather hesitated to employ the procedure of separating the muscle planes and drawing the end of the gut through between them, because he felt that unless great care was taken regarding the blood supply, there was some danger of necrosis. He had found the pneumatic ring a rather good arrangement. In operating, he always took some pains to leave a long segment of the gut, so that there was a loop hanging down into the pelvis, which acted as a sort of reservoir for the feces, and prevented a constant discharge. Such an arrangement gave the fluid portion of the feces time to be absorbed.

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, March 2, 1908.*

The President, DR. WILLIAM J. TAYLOR, in the Chair.

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### CARIES SICCA.

DR. MORRIS B. MILLER presented a woman, aged 22 years, whose personal history was without interest until five years ago when she suffered from a prolonged and severe attack of typhoid fever complicated with pneumonia. Approximately two months after she got perfectly well her arm became weak at the shoulder and remained that way until something over a year ago when within a few weeks she lost entirely the power to raise it at the shoulder and it commenced to pain. The muscles became shrunken and the fixation grew pronounced over a period of three or four months. From the first she has had severe pains resembling neuralgia but not responding to any form of treatment. These are mainly of the area immediately surrounding the joint, but some pain is referred down the arm. Any effort to move the firmly ankylosed shoulder-joint causes considerable suffering. The clinical phenomena are clearly those of caries sicca. There is no pulmonary lesion perceptible.

Dr. Miller said he believed this condition must occur more frequently than one would gather from the literature, and he thinks it may possibly be that this condition is frequently diagnosed as arthritis. He would like to have raised the question whether, in the light of the disability his patient presented, and particularly the neuralgic pain of which she complained, an excision would be warranted and whether it would result in an improved condition.

RESECTION OF SPINAL ACCESSORY NERVE FOR  
TORTICOLLIS.

DR. ROBERT G. LE CONTE exhibited a boy of eleven upon whom he had operated six months previously for congenital torticollis. The patient's head, from birth, had been drawn to the right side, with the chin towards the right shoulder, and it was impossible for him to bring his face to the front. The right sternocleidomastoid muscle appeared to be twice as thick and strong as the left. With an anterior incision at the upper portion of the sternocleidomastoid the spinal accessory nerve was exposed before it entered the sternomastoid muscle. It was resected for a distance of half an inch.

The patient made an uneventful recovery, and now has perfect control and freedom of the motions of the head in all directions.

## RUPTURE OF THE SPLEEN.

DR. GEORGE G. ROSS read a paper on Rupture of the Spleen, with Report of Cases, for which see page 66.

DR. JOHN H. GIBBON referred to a case of rupture of the spleen which he had reported before the Academy some years previous. He believed that localized tenderness and rigidity were the most valuable symptoms we have for locating the injured viscus. In nearly all of the cases of rupture of the spleen which have been reported there has been marked localized tenderness and rigidity. Dr. Gibbon believed that if the spleen were not so easily removed fewer splenectomies for rupture would be reported, since in the majority of these cases hemorrhage can be controlled by judicious packing. In order to control bleeding from large wounds of the spleen it may be necessary to crowd the spleen firmly up against the diaphragm. Dr. Gibbon believed that any case that lived for four or five days after the rupture had occurred could be saved without splenectomy.

## END-TO-END ANASTOMOSIS OF THE BRACHIAL ARTERY.

DR. FRANCIS T. STEWART reported the following cases:

CASE 1.—A. L., aged 42 years, was admitted to the Pennsylvania Hospital June 14, 1905, in the service of Dr. Le Conte, to whom the author is indebted for the privilege of operating upon and reporting this case. The patient had been struck on the inner

side of the arm just above the elbow with a piece of flying steel. The profuse bleeding which followed was readily controlled by pressure. Subsequently the arm became greatly swollen, the skin tense, and a number of large blisters appeared over the forearm. The radial pulse was absent. The X-ray showed the piece of steel,  $\frac{3}{8} \times \frac{1}{8}$  inch in size, just beneath the skin. Two days after the injury a 5 inch incision was made along the inner side of the biceps, and the brachial artery exposed at the upper angle of the wound and compressed between the fingers of an assistant. The vessel was then traced downwards until the wound in its walls was found. The piece of steel was removed with the mass of clots which surrounded the artery. The wound in the artery was transverse and involved half of its circumference. One of the brachial veins had been severed, but was closed by agglutination of its walls the result of compression. After ligating the vein the arterial wound was sutured with through and through sutures of fine silk, which controlled the bleeding but also dangerously narrowed the lumen of the artery. The injured segment of the artery was therefore resected and an end-to-end anastomosis performed by the Murphy method. This necessitated flexion of the elbow, in which position the arm was dressed on an internal angular splint. The radial pulse had disappeared by the time the dressing was completed, but reappeared the following day, although very feeble. The wound was not drained, and primary union occurred. Two months after operation the forearm could be almost completely extended, the radial pulse was as strong as on the sound side, and there was some neuralgic pain along the course of the median nerve.

CASE 2.—J. M., aged 32 years, was admitted to the Germantown Hospital, May 22, 1906, with a bullet wound on the inner side of the right arm just below the axilla. The following day the arm was greatly swollen and the radial pulse absent. The artery was exposed and compressed as in the preceding case, and a lacerated wound involving three-fourths of the circumference of the vessel found. As approximation of this wound obliterated the lumen of the vessel, the injured portion was resected, and the ends united with silk sutures passing through all the coats. After turning on the circulation a few additional sutures were applied to control the oozing. The wound was closed without drainage and healed by first intention. A feeble radial pulse

could be felt immediately after the operation and this increased in strength from day to day. The bullet could not be found at the operation nor could it be shown by an X-ray plate.

Dr. Stewart said further that in addition to the above cases 8 others had been reported in which circular arteriorrhaphy had been performed for accidental wounds (1897, Murphy, Djemil Pacha, two cases; 1899, Kümmel, Krause; 1902, Fergusson; 1904, Delanglade; 1906, Brougham), not including cases of aneurysm. Of these 10 cases the axillary artery was involved in 3, the brachial in 2, the radial and ulnar (same patient) in 1, the femoral in 3, and the popliteal in 1. In 3 the wound was caused by a bullet, in 1 by a piece of steel, in 1 by a stab wound, and in 5 the vessel was accidentally opened during a surgical operation. The largest amount of vessel resected was 2 inches (femoral). In 7 cases the vessel was united with silk; in 3 the suture material was not mentioned. The Murphy method was employed in 8 cases and simple approximation in 2. In 5 cases the peripheral pulse could be felt at the close of the operation and in 5 it was absent immediately after the operation. Infection occurred in at least 3 cases and gangrene in 2 (femoral and popliteal). In no case was secondary hemorrhage or aneurysm reported.

At the present day ligation is contraindicated for a clean wound of a large artery. Unfortunately in the very cases in which arteriorrhaphy for wounds is most strongly indicated, *i.e.*, in those with chronic arteritis, in whom the danger of gangrene after ligation is much increased, the sutures are apt to tear out during the operation or thrombosis is likely to occur subsequently. Even in these cases, however, he believed arteriorrhaphy should be tried, since when one considers the probability of section of the vessel by a ligature, the dangers of suture are at least no greater than ligation, and in the event of thrombosis the patient is no worse off than after the application of a ligature; indeed if the thrombus forms slowly the collateral vessels may sufficiently dilate to prevent gangrene in the affected part.

DR. JOHN H. GIBBON thought that in Dr. Stewart's first case a prompt clot had formed at the site of anastomosis. This is indicated by the disappearance of the radial pulse before the patient left the operating table, and its gradual reappearance would indicate the establishment of collateral circulation. In this case the invagination method was employed which is now recog-

nized as being faulty, because there is not a close contact between the intima of the two portions of the divided vessel. In Dr. Stewart's second case he did an end-to-end anastomosis with a close approximation of intima, and there was evidently no obstruction after the operation. Dr. Gibbon believes with Dr. Stewart that arteriorrhaphy is to be preferred to ligation wherever possible.

DR. STEWART thought Dr. Gibbon's criticism was correct, and that thrombosis must have occurred in the first case. In his report he simply classed the cases according to whether the pulse was or was not present immediately after operation. Although his report shows that 8 of the 10 cases were done by the Murphy method, Dr. Stewart thinks there can be no doubt that the simple approximation, or the Carrel circular arteriorrhaphy is to be chosen by all means. He was at first going to say that he did his second case by the Carrel method, but was afraid Carrel might object as the edges were slightly inverted instead of everted, and he did not use the guide sutures of that surgeon.

Dr. Stewart thinks that the Murphy method is little used at the present day, although it was the pioneer one and paved the way for the progress which has been made along this line.

#### GUNSHOT INJURY OF THE LEFT HYPOGLOSSAL NERVE.

DR. JOHN B. ROBERTS reported this case, as follows:

A man was admitted to the Polyclinic Hospital on the 28th of March, 1907, with a gunshot wound of the left cheek over the ramus of the lower jaw. The point of entrance was about three-quarters of an inch below and about three-quarters of an inch in front of the lower edge of the lobe of the ear. The tongue when protruded pointed very much to the left (Fig. 1), showing that the hypoglossal nerve was paralyzed. The left side of the man's face was covered with sweat, and the left pupil slightly dilated suggesting irritation of the sympathetic nerve.

Dr. William G. Spiller examined the patient two days after his admission and supplied the following notes:

The left facial nerve is very paretic but not completely paralyzed. The upper branch of the nerve has probably escaped injury. The man can nearly close the lids of the left eye. The left side of the tongue is completely paralyzed. The organ while in the mouth deviates to the right, but is greatly deviated to the left when protruded. He is unable to move the tongue to the

left, except a very little beyond the median line, unless it is protruded. This shows injury to the hypoglossal nerve. The soft palate is moved well on both sides when he says "Ah!" and is not paralyzed. He swallows fluids without difficulty when he is sitting up. The pneumogastric and glossopharyngeal nerves have probably escaped injury. The sympathetic has been injured.

He sweats profusely on the left side of the face. The sweating also extends down to the upper part of the shoulder and upper part of the left arm. The right side of the face is dry. The jaw is not deviated when his mouth is open (Fig. 2). The masseter muscles contract well on both sides. Sensations of touch and pain are normal on both sides of the face. Salt and sugar are both well tasted on the left side of the tongue. The grasp of the hands and the power of the legs are normal. There are no symptoms of involvement of the brain.

The left pupil is slightly dilated but seems to react to light.

On April 3d, after locating the bullet by means of two X-ray pictures, Dr. Roberts operated for extraction of the missile. The wound in the cheek was suppurating, though it had been packed with iodoform gauze. The probe showed that the bullet had gone through the ramus of the mandible a short distance below the sigmoid notch. An incision was made around the angle of the jaw and the parotid gland pushed forward. By burrowing with a finger he was able to get behind the pharynx and explore the region in front of the first and second cervical vertebræ. He could feel distinctly the transverse portion of the first vertebra and with some manipulation was able to discover what seemed to be a foreign body, which was slightly movable, to the inner side of the mastoid process in front of the second cervical vertebra. A porcelain tipped probe being introduced proved this to be lead. With forceps such as are used for cleft palate operations he was able to extract the ball. He then found that it had lain in a depression in front of the spinal column and that there were some small fragments of bone there. It is possible that these were pieces carried in from the perforation of the mandible. The space in which the ball lay was either the normal space between the first and second transverse processes or was a depression made by the bullet in the body of the second vertebra. The depth of the wound made it impossible to definitely determine whether the hypoglossal nerve at this point was actually divided, though it

FIG. 1.



Gunshot section of left hypoglossal nerve.

FIG. 2.



Gunshot injury of left hypoglossal nerve.

probably was cut close to the base of the skull. No attempt was made to suture it because of the danger of operating in such a region. The patient's favorable condition and the known rather unimportant results of hypoglossal injury were not such as to warrant interference.

When the man was admitted there was a good deal of difficulty in swallowing from want of control of the saliva; but at the time the operation was done he had gained fair control of these functions and the removal of the bullet seemed to be all that was indicated. The wound was treated by inserting a drainage-tube and packing.

The patient did well for a number of days. He had practically a normal temperature after a slight rise immediately subsequent to operation. On April 6th his temperature went up a little. On the 8th some moist râles in the upper part of the left lung could be heard. He complained of cough which had bothered him for about a day. The drainage-tube was withdrawn and the wound dilated, which evacuated a little fluid, and orders were given to wash the wound out with sterile salt solution twice a day. The drainage-tube was not returned, but the packing was continued. The next day his respiration was practically normal and the lung condition seemed to be better. His cough had been controlled apparently by occasional doses of five grains of ammonium carbonate and a sixteenth of a grain of codeine sulphate. The patient had been allowed for several days to sit up in bed and was advised to lie particularly on his left side to facilitate drainage.

Later sonorous râles were heard in the posterior part of the right chest. There was some tenderness on percussion of the left chest near the posterior edge of the left scapula, and a loss of resonance at the upper part of the right chest posteriorly. The gums were spongy, though no mercury had been taken to cause it. It was thought that possibly the bloody tinge of the expectoration might have come from this gingival condition. Bacteriological examination of the sputum showed the presence of pneumococcus, staphylococcus pyogenes aureus and bacillus proteus vulgaris. Urinary examination showed nothing abnormal. The temperature for a few days previous to this time and also at this time varied from  $100^{\circ}$  to  $102^{\circ}$ ; the respirations from 24 to 28; the pulse from 90 to 100.

An examination of the chest made later by Dr. David Riesman showed that there was impaired resonance on the right side at the fourth and fifth interspaces over a limited area reaching to the axilla. Here crackling râles were heard with feeble breath-sounds and diminished fremitus. There was some pain in this region. The patient had had no chill and no night sweats, but was rapidly losing flesh. No tubercle bacilli were found in the sputum. His red blood cells were 2,150,000; white blood cells 26,200; hæmoglobin 85 per cent. The man was emaciated and weak, had a troublesome cough, and his throat seemed a good deal filled up with mucus. There was very little discharge from the original wound or the incision made for the extraction of the bullet. At the end of the month further operation was suggested to explore the wound and to facilitate drainage, but the man declined to submit. By the 7th of May he was very much better and walking around the ward. On the 12th of May he left the hospital without permission, considering himself well enough to go.

In July Dr. Roberts heard that the patient had been admitted to the tuberculosis wards of the Philadelphia General Hospital under the care of Dr. Ward Brinton. Dr. Brinton stated that tubercle bacilli had been found in the feces, but not in the sputum. There was, however, extensive pulmonary involvement. A few days later the patient died. The wounds in the neck and face had become healed. The Resident Physician, Dr. William Shields, had informed him the case was first thought to be one of gangrene of the lungs on account of the odor of the sputum. Tubercle bacilli were not found in the sputum nor was the streptothrix. At the autopsy six slides were taken from a cavity in the right lung and stained for tubercle bacilli but none were found.

The pathological diagnosis made was tuberculous bronchopneumonia. The pathologist was of the opinion that the gunshot wound of the neck involving the hypoglossal nerve had nothing to do with the lung condition.

The further notes of the autopsy, furnished by Dr. Shields, are as follows:

Right pleura firmly adherent from apex to base in midaxillary line. Slight adhesions of the left pleura in the region of the first and second ribs. The pericardium contained 60 c.c. of straw-colored fluid, and extended 7 cm. to right of midsternum.

FIG. 3.



Case of gunshot wound of the left hypoglossal nerve.



In the right pleural sac there were 300 c.c. of straw-colored fluid. Heart smaller than normal, but otherwise negative. Left lung slightly emphysematous and contained some œdematous fluid. Right lung was covered with thick pleura, both layers of which were firmly attached. Both lobes were firmly attached and showed tuberculous bronchopneumonia. The lower lobe contained three good-sized cavities in which was cheesy material. The two lower cavities communicate with a bronchus. The other organs show nothing of importance. The diagnosis was tuberculous bronchopneumonia with chronic adhesive pleurisy.

Little doubt exists that in this case the hypoglossal nerve was divided. The dilated pupil and the unilateral sweating lead to the supposition that the sympathetic nerve was the seat of irritation. It is perhaps possible that the lids of the left eye suggested paresis of the facial nerve, when the real cause of their apparent loss of power was a slight protrusion of the eyeball due to sympathetic irritation. Division of the sympathetic would be expected to cause contraction of the pupil and sinking of the eyeball.

The location of the bullet in front of the second cervical vertebra near its transverse process on the left side corresponds with the upper part of the superior cervical ganglion of the sympathetic nerve. It is opposite this vertebra too that the hypoglossal nerve receives communicating branches from this sympathetic ganglion.

A missile dividing or destroying the hypoglossal nerve by pressure would be very likely to cause coincident irritation of the sympathetic ganglion in the same region. Had the patient lived, part of the spinal accessory nerve or the lingual branch of the trifacial nerve might have been transplanted into the distal part of the hypoglossal in order to restore motion to the left side of the tongue.

DR. JOHN H. JOYSON referred to a case of injury of the median nerve of a peculiar type which he had recently encountered. The man had been struck on the inner side of the arm by a piece of steel scale while driving a bolt through a piece of sheet steel. An X-ray photograph showed a very small piece of steel located in the neighborhood of the brachial artery. The patient complained at this time of tingling or electrical sensations in the ring and little finger, on the palmar surface, or in other

words, in the distribution of the ulnar nerve. Dr. Jopson saw him several days later and had a second X-ray plate made, and localized this very small foreign body in its relation to the wound of entrance, which was the only localizing point that could be utilized, being situated at about the middle of the arm. By this time the sensory disturbances had disappeared to some extent, although the patient complained of them at times when he attempted to use the arm, and still in the distribution of the ulnar nerve. There was slight tenderness over the site of the wound. On exposing the region where the foreign body had been localized a large nerve presented itself, and on examining it closely it seemed at one point to be a little swollen and injected. By probing with a pair of fine forceps Dr. Jopson found an opening in the nerve, and was able to remove the foreign body, which was deeply embedded and completely concealed in what proved to be the median nerve and not the ulnar. It was a thin scale, measuring 4 mm. in diameter. After the operation the patient had the same tingling sensations for 24 hours, but now in the distribution of the median nerve, that is, in the thumb, index and middle fingers, and not in the distribution of the ulnar nerve as formerly.

The reference of the pain to the distribution of the ulnar nerve, rather than to that of the median, was difficult to explain. The foreign body could not possibly have injured it, as the wound of entrance lay between the nerves.

DR. GEORGE M. DORRANCE said that he saw the case reported at the Polyclinic Hospital, and that he followed the patient from there to the Philadelphia Hospital, but lost track of him when his body was sent to the University. The report from the man who macerated the body was that the first cervical vertebra and part of the occipital bone was injured, and from his description of it one would imagine that the nerve was injured just as it came out from the anterior condyloid foramen. Therefore an operation would not have been of value, as it would have been impossible to reach the upper end of the nerve.

# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS.

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### TETANY FOLLOWING THYROIDECTOMY CURED BY THE SUBCUTANEOUS INJECTION OF PARATHYROID EMULSION.

BY JOSEPH H. BRANHAM, M.D.,

OF BALTIMORE, MD.

M. L. L., white, female, American, age fourteen years and four months, was sent to the Franklin Square Hospital, Baltimore, February 21, 1907, by Dr. A. E. F. Grempler, with diagnosis of goitre. The enlargement of the thyroid was noticed in June, 1906, but the growth did not increase very rapidly. For several weeks previous to the operation the patient had been frequently awakened at night by throbbing pain in her neck accompanied by a sensation of choking.

The operation (4.30 P.M., February 21, 1907) was not especially difficult. The tumor on the right side was about the size of an orange and was deeply seated and twisted from its normal plane. This was removed first and while I tried to leave the posterior capsule and to avoid the parathyroids, I felt uncertain of having succeeded, and remarked to my assistant that on the left side where the growth was smaller and its position normal I would be careful not to interfere with these bodies. In this it will be noticed from the pathological report, I was only partially successful, as part of one was removed on this side. The patient lost but little blood and was taken from the operating room at 5.10 P.M. Her pulse, 90 before and 104 after the operation, was strong and regular, and her temperature 37° C. She was making an apparently uninterrupted recovery until 8.00 A.M., February

25—eighty-eight hours after the operation, at which time her teeth became clinched. Shortly afterwards her hands became contracted and her feet affected (*Talipes equinovarus*), wrists flexed on forearms (full flexion) and forearms slightly flexed on arms (at right angles). Reflexes were not exaggerated, no elbow or wrist jerk. The patient's head was thrown back, teeth clinched but her face not distorted, her head, shoulders, buttocks and heels only touching the bed. There was a marked rise of temperature, 38.5° C. The patient says the first indication of the trouble was a stiff feeling around the mouth, and later a drawing up of her thumbs. Her hands became "drawn up" and her feet cramped, also a tingling pain seemed to radiate from her head and shoot over her body and limbs, but at no time was the pain severe. She had great difficulty in swallowing, due solely to inability to move her tongue freely, it being (as she expressed it) "stiff." The symptoms toward the last of the attack were alarming. The tetany was marked by distinct exacerbations much like tetanus. During these the pulse was rapid and weak and the respiration was greatly interfered with. At times she would not breathe for a considerable period and would appear to be in such imminent danger that artificial respiration was necessary.

*Blood.*—Hæmoglobin 85, red cells 2,500,000; leucocytes 12,000; polymorphonuclears 70 per cent., large 4 per cent., small 24 per cent.; eosinophiles 0.40 per cent., transitional 1 per cent., leucocytes counted 1000. This count was made when the contractions were most pronounced. Leucocytosis in this case must have been due in some way to the effect of the operation on the thyroid or parathyroids, as there was no infection.

The patient was ordered 0.192 Gm. of thyroid extract every three hours, beginning Sunday, February 25, at eleven o'clock A.M. Also every four hours she was given 0.0648 Gm. of parathyroid extract, but obtained no relief, in fact, the contractions were becoming more marked all the time. On Monday twenty-eight fresh beef parathyroids were secured. Six of these raw were forced into the patient's mouth and she succeeded in swallowing them. This was repeated on Tuesday morning and again on Tuesday night. The symptoms becoming more pronounced, on Tuesday night five of the glands were placed in 1:1000 solution of bichloride of mercury and allowed to soak about ten minutes. Observing strict asepsis the glands were cut into fine

pieces under physiological salt solution. These pieces were placed into a mortar and ground into a homogeneous mass, 400 c.c. of sterile salt solution being poured into the mortar. This was then filtered through sterile gauze and given as salt transfusion into the patient's breast at 10.00 P.M. At 1.30 A.M. on the following morning she was asleep and the contractions were becoming gradually less violent. They disappeared in her hands, arms and face by 10.00 A.M., and her lower extremities were nearly relaxed. Her temperature dropped from 38.5° C. at 8.00 P.M. on the 27th to 36.8° C. on the 28th. All contractions had disappeared by noon on the 28th, and it was impossible to cause them by pressure on the artery supplying the part. Tapping on the transverse branch of the facial nerve still caused fibrillar contraction, but this disappeared by the morning of March 1. Parathyroids were discontinued by mouth on the morning of the 28th and parathyroid and thyroid extracts were discontinued on the morning of March 1. There were no contractions between February 28 and March 2. At 3.45 P.M., Saturday, March 3, the patient developed a recurrent attack which lasted twenty minutes and involved only the face. This was succeeded by milder attacks which lasted until about 11.30 P.M., at which time she was given two parathyroids subcutaneously in 100 c.c. of salt solution. The attacks ceased almost immediately, and the patient has remained free from any symptoms of tetany up to the present time—more than a year after operation.

When this patient's condition became desperate and the use of the thyroid and parathyroid extracts and the feeding of the raw parathyroids proved entirely useless, I called up Dr. W. G. MacCallum of the Johns Hopkins Hospital whom I knew had been doing much experimental work on tetany, hoping to find some method of using the parathyroids by injection. He told me he had used an emulsion of the fresh glands in dogs many times with no ill effects and with good results, and urged that we try it on our patient. The emulsion was prepared and used at the hospital after his directions.

The pathological examination showed colloid degeneration of the thyroid, right gland much the larger, and on its posterior aspect were found one whole parathyroid and parts of two others. On the left gland which was smaller, part of one parathyroid was

found. Microscopic examination showed the parathyroids to be normal.

The important fact that this case has remained permanently well is probably due to the fact that the parathyroids were not all removed. The parts left were undoubtedly so damaged by the traumatism of the operation that their functions were suspended, but as they recovered, their normal work was resumed and possibly compensatory hypertrophy secured.

## SINUS OF FIRST BRANCHIAL CLEFT.

BY CARLETON P. FLINT, M.D.,

OF NEW YORK,

Assistant Attending Surgeon to the Roosevelt Hospital; Instructor in Surgery,  
College of Physicians and Surgeons, Columbia University.

THE following case is reported because of the rarity of the condition and because it illustrates that a lateral fistula in the neck of congenital origin is not always of second branchial cleft origin.

Henry Goldberg, 21, Russian Jew; stableman. Was admitted to the first surgical division of the Roosevelt Hospital February 20, 1907, on account of a swelling of the neck with a small discharging sinus. During early childhood he had developed tuberculous glands on both sides of neck. These were operated upon, the wounds subsequently discharging pus for months. Last operation 11 years ago. Except for children's diseases, history otherwise negative.

*History of Complaint.*—Ever since a small child he has had a swelling on right side of neck. This caused no symptoms until 4 years ago when it increased in size and was opened just above the clavicle. Since that time there has always been a slight amount of discharge. At times the opening would close, the swelling reappear and become tender. Finally the closed sinus would re-open and relief of symptoms would follow the discharge of contents. When admitted, his general condition was fair. Head, chest, abdomen and extremities negative. Temperature, 98; pulse, 92; respiration, 24. There were stellate puckered scars on both sides of neck, in submaxillary triangles and along anterior margin of sternomastoid muscle. A diffuse, pear-shaped swelling filled the posterior triangle of the right side of the neck up to level of the angle of the jaw. The stem of the pear was upward and was continuous with a dense induration extending behind the sternomastoid at the level of the jaw and from here upwards along the anterior margin of the sternomastoid. Just above the clavicle, the outer margin of the sternomastoid, was a small opening from which exuded, on

pressure, a few drops of cloudy sticky fluid. The sinus was injected with bismuth in water and an X-ray plate taken. This plate (Fig. 1) showed a shadow extending upward, corresponding to the indurated area in shape and direction. Unfortunately the base of the skull is not on the plate.

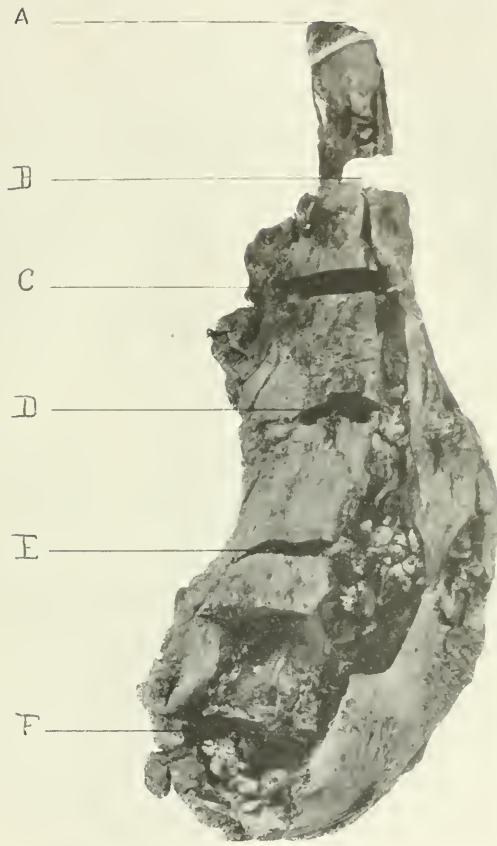
*Operation.*—Incision, the entire length of posterior margin of sternomastoid. The mass was found to have a well marked capsule which enabled easy separation from the sternomastoid, with which it was in intimate contact. At the level of the angle of the jaw the mass narrowed to a rounded strand about  $\frac{1}{2}$  inch in diameter. This passed upward and forward underneath the sternomastoid, and became smaller and firmer and about  $1\frac{1}{2}$  inch below the base of the skull it terminated in a cartilaginous column about  $\frac{1}{4}$  inch in diameter. Throughout the entire length the mass could be shelled with comparative ease from the surrounding structures. The upper end was so firmly attached to the external auditory canal at the junction of the bony and cartilaginous portion, that in the process of removing the external canal was opened.

The relation to the surrounding structures of the neck was as follows: In the posterior triangle of the neck the mass lay beneath the deep cervical fascia with the exception of the sinus at the bottom. Anteriorly it was in contact with the posterior margin of the sternomastoid. Posteriorly and externally it was surrounded by the fat filling the posterior triangle and separating it from the trapezius and structures forming the floor of the triangle.

At the angle of the jaw where it passed forward and upward, underneath the sternomastoid muscle, it came in touch with the jugular vein. The upper portion passed beneath the occipital artery, left the jugular vein and was behind and to the outer side of the stylo-hyoid and stylo-pharyngeus. The last  $\frac{1}{2}$  inch was separated from the styloid process by a space just admitting the forefinger. The facial nerve did not come into the wound so that I am unable to state definitely its relation, but am of the opinion that the nerve crossed behind and to the outer side.

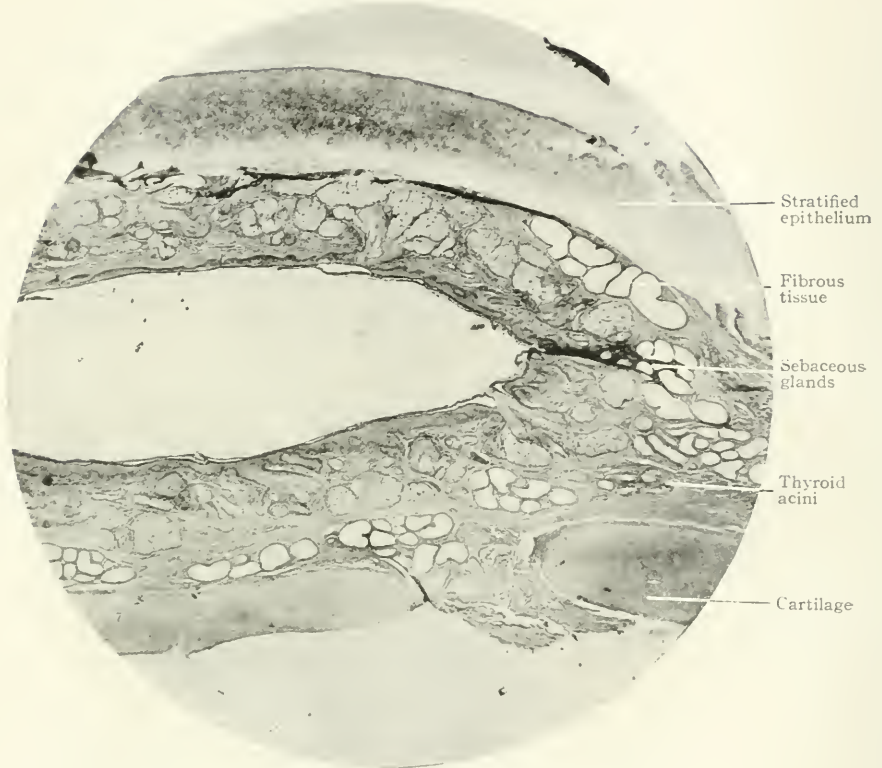
The wound healed by first intention, the patient leaving the hospital on the eighth day. The specimen was preserved in formalin and sections cut from the levels indicated in Fig. 2.

FIG. 1.



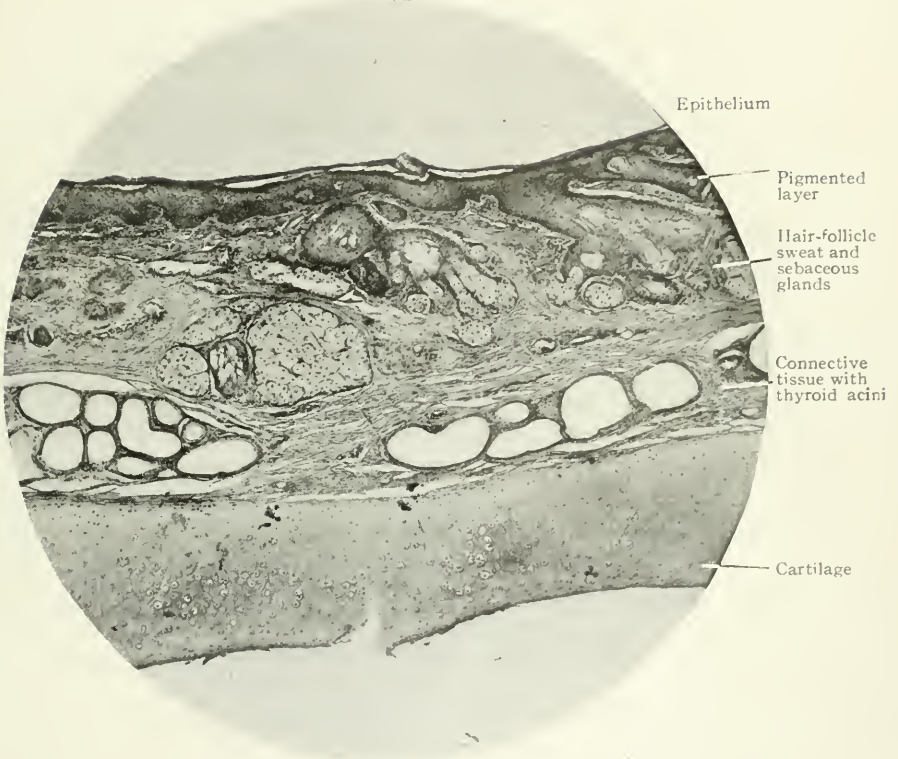
Photograph of specimen.

FIG. 2.



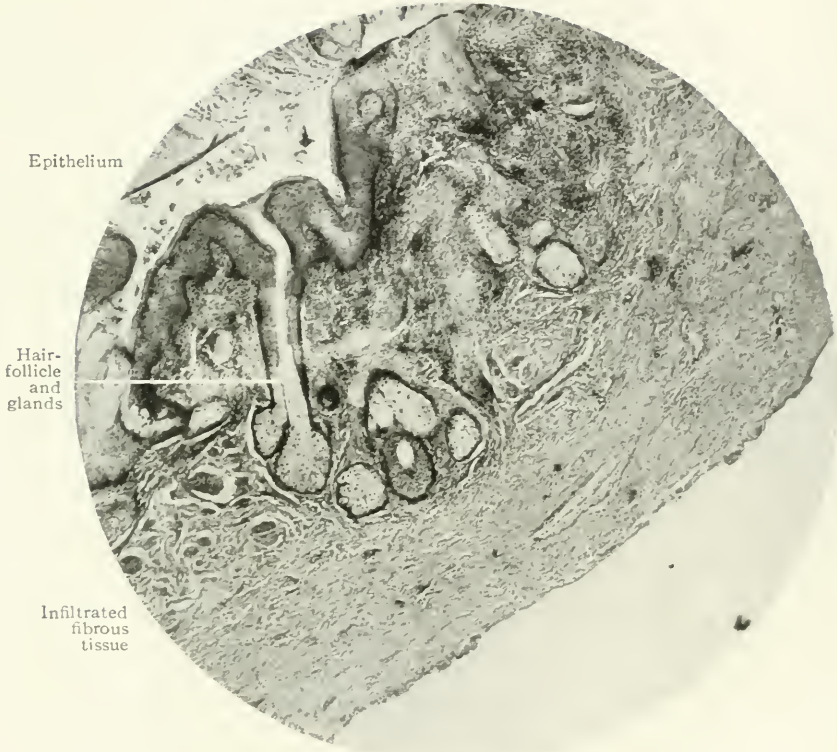
Section of entire cleft at level A. (See FIG. 1).

FIG. 3.



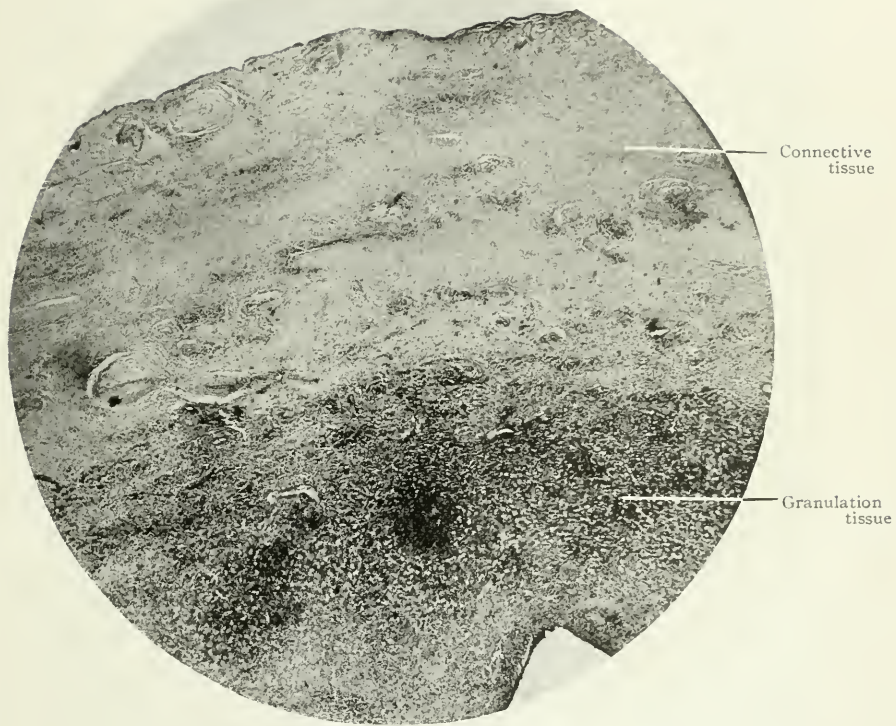
Enlargement of section shown in FIG. 2

FIG. 4.



Enlargement of section taken through secondary cyst at level B. (See FIG. 1).

FIG. 5.



Taken from lower levels. C, D, E, Fig. 1 present same conditions.

FIG. 6



Tip of  
mastoid

Radiograph showing cavity of sinus injected with bismuth subnitrate.

The pathological report follows:

The cyst is a pear-shaped structure having a length of 12 cm. and a transverse diameter at the widest part of the cyst body of 4 cm. (Fig. 1.) The neck is 3 cm. long and has a diameter of 1 cm. at its upper end and  $1\frac{1}{2}$  cm. where it begins to widen out into the cyst body. The lumen of the upper end of the neck measures  $\frac{1}{2}$  cm., and about the circumference of this part there is a smooth plate of cartilage on one side and irregular cartilage formation on the other. Two centimeters below the opening of the cyst and leading off from the canal of the neck there is developed in the wall a secondary cyst cavity 1 cm. long.

SECTION *A*.—Made transversely across the upper end of the neck, shows the following structure from within out:

*First*.—A layer of stratified squamous epithelium identical with that found on the general skin surface, having the typical horny layer and epithelial cells. Two or three layers of the superficial epithelium lying immediately under the horny layer contains a large amount of black granular pigment.

*Second*.—Beneath the epithelium there is a thin margin of very dense fibrous connective tissue through which are scattered young fibrous tissue cells.

*Third*.—A zone of very large sebaceous glands which are so numerous and closely packed together as to form a distinct layer. A few very wide ducts can be seen running from these glands to the surface of the lumen through the epithelium. The glands are held together by very firm fibrous tissue. A few hair follicles are scattered through this gland layer.

*Fourth*.—A layer composed of thyroid gland tissue. The acini are very large and lined with low cuboidal epithelium which throughout contains a large amount of light yellow granular pigment. A few of the acini contain colloid.

*Fifth*.—A zone of normal cartilage which is represented by a single plate on one side and by three smaller plates on the opposite side of the wall. The cartilaginous plates are held together by very dense fibrous tissue.

SECTION *B*.—Made  $2\frac{1}{2}$  cm. below section *A* includes a section through the secondary cyst. This pouch is lined by stratified squamous epithelium, having a horny layer, beneath which are a few sebaceous glands and hair follicles. Around the epithelium and glands is a layer of very dense fibrous connective tissue extensively infiltrated by inflammatory round cells and leucocytes. The main canal in this section shows a lining of thick granulation tissue composed of young fibrous tissue cells, leucocytes and young blood vessels. Outside of this inflammatory layer the wall is composed of dense fibrous tissue infiltrated with young fibrous tissue and migrating inflammatory cells.

OTHER SECTIONS.—Taken at 4 cm. (C), 6 cm. (D), 8 cm. (E) and 12 cm. (F) from the neck of the cyst show a fibrous tissue wall lined by granulation tissue containing few squamous cells.

*Points of Particular Interest.*—First, lateral sinus of neck from first cleft; second, presence of thyroid tissue; third, relation to structures of second arch, the sinus being behind and underneath the upper portion of sternomastoid muscle.

## TECHNIQUE OF EARLY OPERATION FOR THE REMOVAL OF TUBERCULAR CERVICAL LYMPH NODES.\*

BY CHARLES N. DOWD, M.D.,

OF NEW YORK,

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Free Hospital for Children.

IN the removal of tubercular cervical lymph nodes thoroughness is surely very important. All infected nodes should be removed, when practicable, for, although the encapsulation of a limited infection is possible, its spread to other tissues is much more probable. The effort to procure thoroughness in this operation has frequently led to an utter disregard of the scars which are produced, and patients are frequently deterred from operation through fear of the resulting disfigurement. In certain cases of advanced and general cervical tuberculosis this disregard of resulting scars is to be advocated. It is better to save life and leave scars than to sacrifice the patient.

In other instances, however, a scar-saving operation is compatible with thoroughness. The infection in about 85 per cent. of the cases as they appear in New York first involves the subparotid group of lymph nodes; the nodes which form the first barrier to the spread of infection from the pharynx and tonsillar region. There is a characteristic appearance to the patients during the early part of this infection. The accompanying photograph (Fig. 1) indicates this appearance. The nodes just below and behind the angle of the jaw and under the upper part of the sterno-cleido-mastoid muscle are enlarged, slightly movable, rather tense, and usually free from evidence of acute inflammation. They frequently remain in this condition for several months, sometimes increasing and again

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\* Read before the Surgical Section of the New York Academy of Medicine, February 7, 1908.

diminishing in size; and during this period they may usually be thoroughly removed through a transverse incision, which is about two and a half inches in length, which lies in, or parallel to, the folds of the neck and which, after healing, is hardly to be seen.

The arrangement of the infected nodes in these early cases is almost uniform, and the technique of their removal is as definite as that of the average surgical procedure. The writer ventures to give diagrams showing the stages in an operation which he has found very useful in many cases, hoping in this way to promote early operations for these patients. These diagrams are photographs taken during the operation on the child shown in Fig. 1, or drawings from such photographs.

The skin incision is indicated in Fig. 2. It is made at least a finger's breadth below the border of the jaw, and should be straight and parallel to a neck crease. After reaching the platysma, the skin should be drawn downward and the incision to or through the deep fascia may be made at a little lower level than the skin incision. The collo-mandibular ramus of the facial nerve lies between the platysma and the deep fascia, and by suitable retraction it can be carried upward with the muscle, and its injury thus avoided.

The exposure which exists after this step is shown in Fig. 3. The margin of the sterno-mastoid muscle may then be retracted backward, freeing it from its attachments considerably above and below the site of the incision. The tonsillar node is then usually clearly brought into view and, by blunt dissection, may be detached from its anterior attachments, but should not be separated from the adherent nodes behind it. The mass of nodes which is grouped here is usually much larger than would be indicated by the external appearance of the neck. Their capsules may be grasped by toothed clamps and their attachments divided so as to give about the appearance indicated in Fig. 4.

As the deeper portion of this mass is being separated from the surrounding tissue there is danger of dividing the spinal accessory nerve above its entrance into the sterno-

mastoid muscle. The nerve is often completely surrounded by the node mass and may easily be mistaken for a portion of its capsule. In searching for it the portion of the node mass which is shown in Fig. 4 is often separated from the nodes which lie still higher and further back under the sterno-mastoid muscle.

Fig. 5 indicates its appearance after such separation, the deeply lying node on which it rests being drawn forward and the anterior border of the sterno-mastoid muscle being turned backward. The nodes may then be removed from beneath the upper part of the sterno-mastoid muscle as far back as its posterior border. This should leave a clean dissection of the area between the skull and line of the incision.

The nodes below this incision and beside the internal jugular vein may then be grasped by clamps and drawn upward while the lower margin of the wound is drawn downward, giving the appearance indicated in Fig. 6. By careful dissection and suitable retraction the node-containing area may then be explored almost down to the clavicle, and backward into the posterior chain behind the lower posterior margin of the sterno-mastoid: avoiding of course the lower part of the spinal accessory nerve in this region. The lower extent of the area here exposed is shown in Fig. 7. If there is difficulty in the dissection of this lower area, a second transverse cut may be made just above the clavicle.

Fig. 8 indicates the appearance of the wound area at the close of the dissection, but does not show the entire extent of this area, since the skin can be moved both upward and downward by retraction.

The method of wound treatment is important. Drainage should be provided, since there are wide spaces for the collection of serum, and possibly lymph and blood; and since there are defective lymphatics to provide for their absorption. A limited drainage, however, is usually sufficient. The method shown in Fig. 9 has proved satisfactory; a counter-opening is made below the incision and several strands of silk or silk-worm gut are passed through this and through the wound.

The wound itself is closed with subcuticular stitches, excepting at the drain opening, a small piece of moist gauze is there applied, covered by rubber tissue and kept moist by the application of a few drops of saline solution applied under the rubber tissue every few hours.

In many cases this drainage, of course, is not needed, but where there are broken down nodes it is often very important, and it is a safe and easy method for all and if properly cared for is almost an absolute safeguard against deep-lying infection.

The patients are usually allowed out of bed on the second or third day after the operation and can leave the hospital within ten days, or two weeks.

The patient from whom these pictures were taken has remained free from recurrence; it is now two and a quarter years since his operation. Fig. 10 shows his appearance one year after operation. The scar is hardly to be seen, and he is very sturdy and strong.

The *possibility of vein injury* may be considered in a separate paragraph. There is of course extensive vein exposure in this dissection and the possibility of vein injury. Probably the vein most frequently injured is the posterior facial (see diagram, Fig. 11). It is occasionally adherent to the upper part of one of the enlarged nodes, and in the retraction it looks like a part of the node capsule and if nicked it may give a bothersome hemorrhage in an unexpected place, and since one naturally looks to the internal jugular as the probable source of such a hemorrhage, the real source may not be discovered at once. Small veins which run from the nodes into the large veins are also frequent sources of hemorrhage. When flattened out on the node they are not to be distinguished from the node capsule, and since they are close to the internal jugular or common facial veins their section may easily cause troublesome hemorrhage. Fig. 12 shows such a vein and Fig. 13 shows other inconstant veins which have been noted during operation.

An injury of one of these veins near its distal end is

FIG. I.



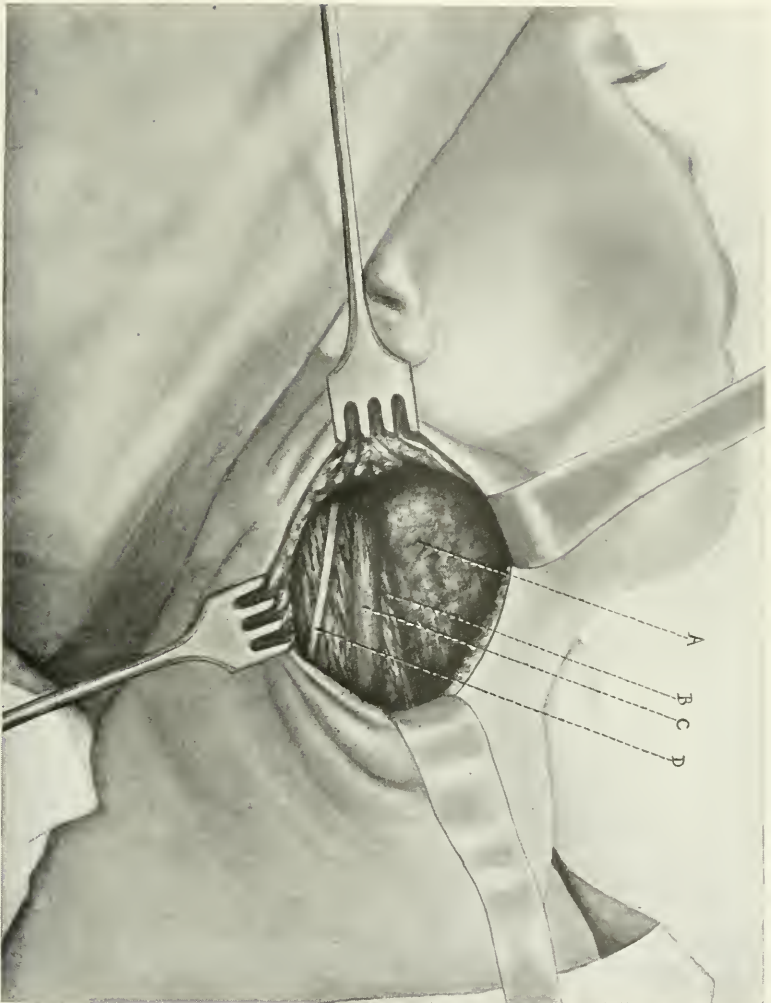
Early case of tuberculosis of the cervical lymph nodes. The swelling had first appeared about ten months previously: in the meantime the nodes had increased, diminished and again increased in size. The subparotid nodes which are here shown, are apparently the first ones enlarged in about 85% of the cases as they appear in New York.

FIG. 2.



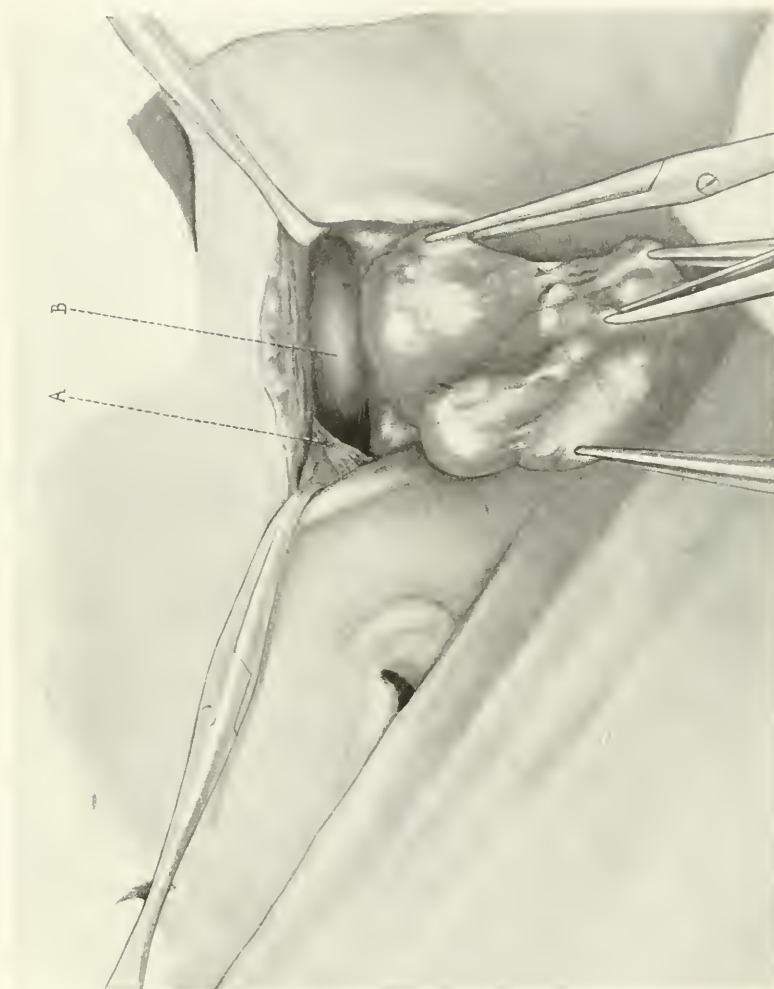
Incision : made at least a finger's breadth below the border of the jaw and in, or parallel to, a neck crease.

FIG. 3.



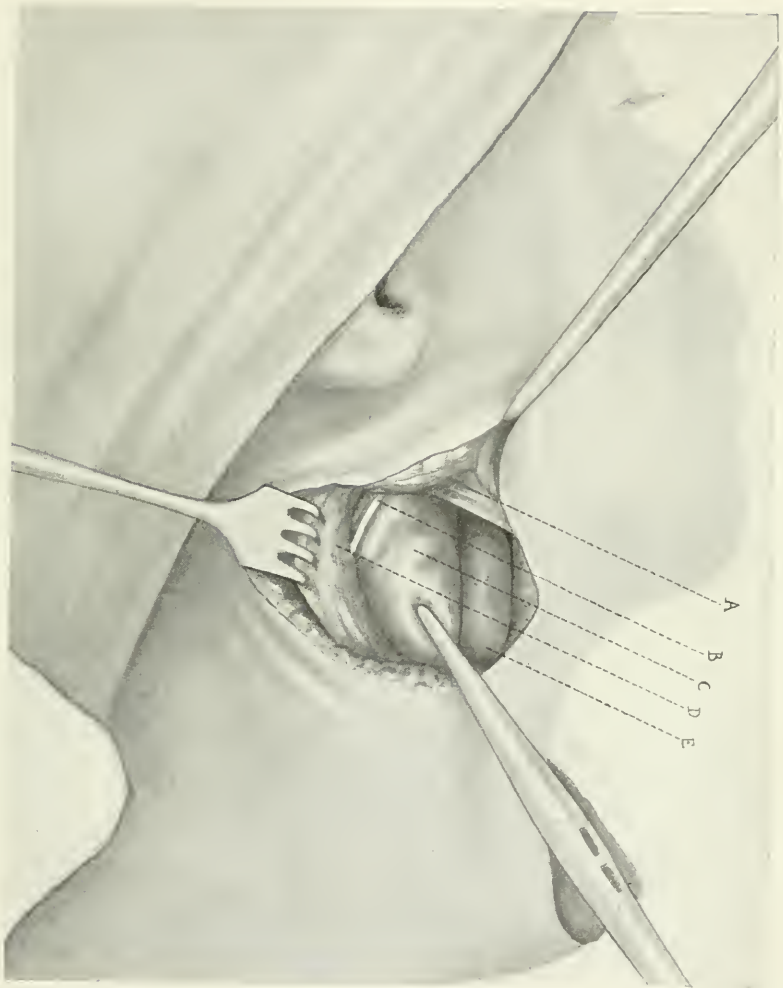
Exposure after retraction of platysma and deep fascia. A, Lymph nodes. B, Sternomastoid muscle. C, External jugular vein. D, Great auricular nerve.

FIG. 4.



Main mass of lymph nodes, drawn out and reflected backward. A, Posterior belly of digastric muscle. B, Internal jugular vein.

FIG. 5.



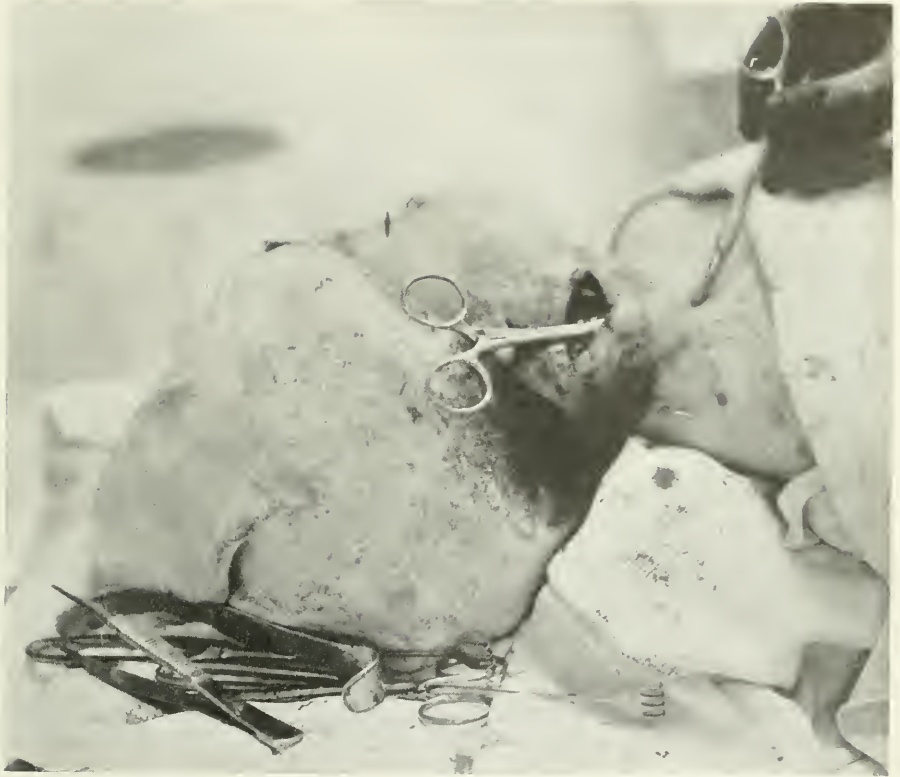
Exposure of spinal accessory nerve. A, Posterior belly of diaphragm muscle. B, Spinal accessory nerve. C, Deeply lying lymph node, drawn forward. D, Sternomastoid muscle drawn backward. E, Internal jugular vein.

FIG. 6.



Removal of nodes from the lower part of the deep cervical chain. A, Internal jugular vein. B, Sternomastoid muscle. C, External jugular vein. D, Great cervical nerve. E, Nodes from the deep cervical chain drawn forward, upward and outward.

FIG. 7.



Showing lower extent of area from which nodes are removed. The internal clamp reaches to the spot indicated by the point of the external clamp.

FIG. 8.



Photograph taken at the end of operation to show the extent of the exposure which is obtained through the transverse incision. The internal jugular vein passes prominently across the field.

FIG. 9.



Wound closed by subcuticular sutures. Drain of silk worm gut strands introduced under the sternomastoid muscle emerging through a posterior counter opening.

FIG. 10.



Photograph of patient one year after operation. Two and a quarter years after operation he was shown at the New York Surgical Society without recurrence and with a scar even less noticeable than this photograph indicates.

FIG. 11.

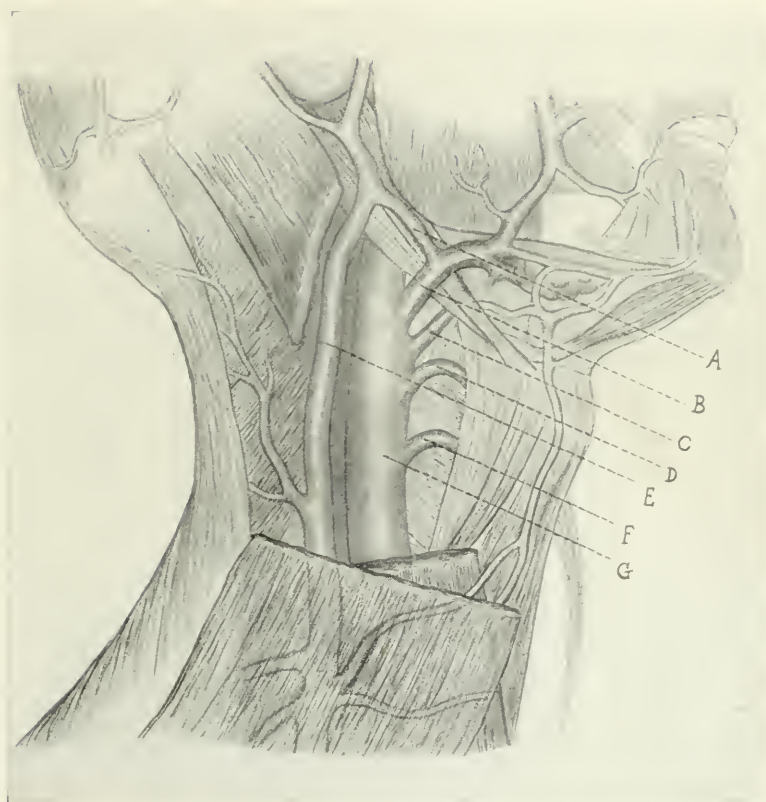
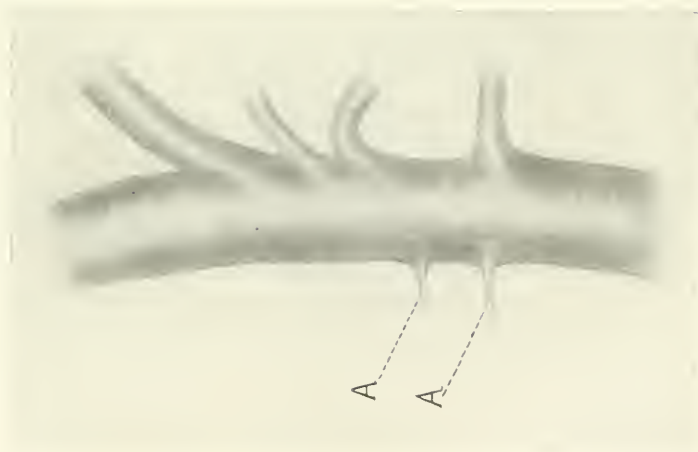


Diagram of veins of neck adapted from Gray's anatomy. Showing the location of the posterior facial vein (A) from which bothersome hæmorrhage may easily occur. A, Posterior facial or anterior temporomaxillary vein. B, Common facial vein. C, Lingual vein. D, Laryngeal vein. E, External jugular vein. F, Superior thyroid vein. G, Internal jugular vein.

FIG. 12.



A, A, Inconstant branches, entering the internal jugular vein from behind where they may easily be injured.

FIG. 13.



Small vein (A) running from lymph node into common facial vein: where flattened by traction it resembles a node capsule. Its section near the main vein is practically a wound of that vessel.

practically an injury of the internal jugular. If it should occur or if the internal jugular itself should be incised, the opening should be secured by one or more artery clamps and then included in an over-and-over suture of small silk, thus preserving the lumen of the vein.

The writer can report on 66 cases which, in condition of lymph nodes and type of operation, may be classed with the one here figured. These patients all recovered from the operation within a reasonably short time. There was only one serious complication in their number—a secondary hemorrhage from the internal jugular vein, which occurred in an infected case on the ninth day after operation. It was controlled by pressure, but to avoid its recurrence the vein was ligated above and below, and prompt healing followed.

The later history of these cases has been followed with much care. One has been followed nearly five years from the time of operation; 12 have been followed into the fourth year; 9 into the third year; 18 into the second year; 15 into the first year; 12 have not been observed since leaving the hospital.

The appearance of these cases as they have been examined at various periods after operation has been almost uniform. There are usually a few small superficial nodes in the posterior chain which are just palpable, hardly larger than peas. The tonsillar node on the other side of the neck is usually about the size of a lima bean, otherwise no enlarged nodes can be felt. These enlargements are, I believe, hyperplastic and not tubercular, due probably to the increased demand which is made upon the nodes after the removal of so many others.

I have watched nodes of this kind year after year and have hardly ever seen them increase in size, and have frequently seen them subside. A few of them have been removed and almost without exception have been found to be hyperplastic.

Among these 66 cases there are three who have filbert-sized nodes which may be regarded as recurrences. In a

fourth one a discharging sinus appeared in the wound area; it closed spontaneously; he also had a node removed from the parotid gland by operation. No doubt there will be some other recurrences among these 66 patients, but the present report of only four known recurrences is surely very encouraging, and indicates that there is a large class of these early cases for whom an operation may be done which is safe and thorough, which hardly leaves a scar, and which is followed by a very large proportion of cures. These favorable cases are found more often among the well fed and well housed people, particularly children, than among those less fortunately situated.

The report of this type of early cases should be accompanied by a brief report of all the writer's cases, extensive and otherwise. There are 256 of them. There was only one operative death in the entire number; it occurred in a very unfavorable case, from secondary hemorrhage from the internal jugular. These cases have been followed for long periods, varying from 12 years down. The exact details are not now in available form and will be given in a later report, but they bear out the indications of the report made in 1905 of between 75 and 80 per cent. of apparent cures, and many other cases who will probably be cured after further operations.

## DESMOID TUMORS OF THE ABDOMINAL WALL.

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THE term "desmoid" was first used by Johannes Mueller<sup>1</sup> with application to certain tumors of connective tissue origin, and as the name implies, of "tendon-like" consistency, arising from the abdominal wall. These tumors are so unusual, and present such interest and possible difficulty in diagnosis, that the recent occurrence of a case in the clinic of Dr. Watts, at the University of Virginia, suggested the advisability of placing the case on record, with a brief résumé of the literature of the subject.

It is well, first of all, to determine what shall, and what shall not be included under the term desmoid. There have been some who would so classify the fibro-miomata of the round ligaments arising in the canal of Nuck, but essentially analogous to the ordinary uterine myomata. Similarly, the tumors to which attention was called by Nélaton,<sup>2</sup> arising from the bony pelvis and invading the abdominal wall, have been considered desmoids; but the weight of opinion is decidedly toward excluding these classes of tumors from the category of true desmoids. The conception of Pfeiffer,<sup>3</sup> which is also that authorized in v. Bergmann's "*Handbuch der Praktischen Chirurgie*," would restrict the use of the word "desmoid" to fibromata or fibro-sarcomata arising from the musculo-aponeurotic structures—muscles, muscle-sheaths, aponeuroses, lineæ transversæ, etc.—of the abdominal wall itself, thus excluding tumors originating in the bony pelvis or the round ligaments, as well as those springing from the skin or subcutaneous tissues.

In reviewing the literature, one is struck by the fact that the great majority of the articles on the subject are reports of single, or at most, three or four cases. There are, however,

two prominent exceptions to this general rule, in the monographs of Ledderhose<sup>4</sup> and Pfeiffer.<sup>3</sup> The first of these writers has collected 100 cases from various sources; the second reports 40 cases of his own, to which he adds 360 more cases collected from the literature, including the 100 cases of Ledderhose already mentioned, thus making a total of 400 cases in all. So thoroughly has the last author worked over the literature up to the date of his publication, that we feel it unnecessary to do more than refer the reader to this article with its voluminous bibliography, for work done before 1904. Since that date, we have been able to collect the following cases, which we report here in brief abstract.

CULLEN<sup>5</sup>: Mrs. N. M., 30 years old. No note of pregnancy. Tumor in left hypochondrium. Tumor lobulated and freely movable. At operation it was found to be attached to the sheath of the abdominal muscles, and in removing it, some of the muscle was taken out with the tumor. Pathological report: pure fibroma.

SCHWARZSCHILD<sup>6</sup>: Case I. Woman 28 years old. Tumor present in right side of abdomen for 2 years; growth very slow. For past half year, following directly upon labor, growth has been more rapid. Tumor is now the size of a child's head, hard and nodular, and attached to abdominal wall. Diagnosis: fibroma. At operation, the tumor was found to be closely adherent to peritoneum and a large defect was left by its removal, which was closed by a plastic operation. After one year, no recurrence, no hernia. Pathological report not made.

Case II. Woman, 30 years old, mother of two children. In the right lower quadrant of abdomen is a tumor, the size of a hen's egg, which is attached to abdominal wall, but not adherent to the skin. At operation the tumor was found to spring from the posterior surface of rectus, but was not adherent to peritoneum, which was not opened. Diagnosis: desmoid.

EITEL<sup>7</sup>: Mrs. J., aged 26 years. Tumor above and to left of symphysis pubis, of 10 months' duration and slow growth. Slight pain. Tumor size of fist, hard, encapsulated, deeply embedded in abdominal wall. At operation, tumor was found just beneath external oblique muscle, involving all the structures down to the peritoneum, to which it was adherent. Apparently tumor originated from fascia transversalis. Good closure without plastic. Patient now well. Pathological report: very cellular fibroma.

GROSS AND SENCERT<sup>8</sup>: Woman 73 years old. Tumor of 10 years' standing, arising to left of middle line and occupying whole left half of abdomen. Tumor very large, weighing 6 kg., and extensively ulcerated. Patient in condition of septicæmia. Tumor found at operation to be

attached by pedicle to the anterior sheath of rectus, and originating at the position of one of the lineæ transversæ. Pathological report: partly gangrenous lipo-fibroma.

ECCLES<sup>9</sup> and BEDWELL<sup>10</sup> report several cases of fibro-sarcomata of the abdominal wall, and another case is reported by TAPIE and DAUNIC<sup>11</sup> but the writer was unfortunately unable to gain access to these articles.

Besides these cases, five others have been collected from the surgical service of the Johns Hopkins Hospital, for the permission to use which we wish to thank Dr. Wm. S. Halsted and Dr. Jos. C. Bloodgood of that institution. These cases were grouped under the caption "tumors of the abdominal wall," and were collected from a general surgical service now exceeding 21,000 cases of all kinds. The abstracts follow.

CASE I.—A man, aged 27, with tumor just below umbilicus in mid-line. Duration 6 years. During the past 5 months, more rapid growth has been observed. Tumor is hard, smooth, just under skin, freely movable. Tumor easily enucleated. No statement as to attachment of tumor to deep structures. Microscopically, the tumor is composed largely of spindle cells.

CASE II.—Woman, aged 56. Has borne a child. Shortly after labor, a painless, slow-growing tumor appeared just to left of umbilicus. Tumor was incompletely removed, the wound became infected, and healed with a large scar. For the past 20 years there has been a gradual recurrence in this scar, the tumor involving the skin. For five years, the tumor has been ulcerated, which patient attributes to trauma. Lately two small secondary nodules have appeared in skin to right and left of original growth. Tumors are hard, freely movable on deep structures, but firmly fixed to the skin. Tumor easily removed, and no note made of any attachment to deep structures. Pathological report: spindle-celled tumor.

CASE III.—Woman, aged 23 years, with tumor of 6 months duration, onset following pregnancy. Tumor to the left and below umbilicus, is palpable but not visible. Tenderness prevents accurate palpation, or definite outlining of mass. Fixed to deeper structures. At operation, tumor is found to be attached to posterior surface of the sheath of rectus.

CASE IV.—Woman, aged 35 years, with rapidly growing tumor of the right lower quadrant of abdomen, following pregnancy. No pain. Tumor is hard, nodular, with skin freely movable, and itself movable on deep parts. At operation, tumor is described as subcutaneous, but note states that part of rectus had to be removed with it, because of its firm adherence to the anterior sheath of that muscle.

CASE V.—Colored woman, aged 18. Tumor appeared during pregnancy, to left of and just below umbilicus. Only a few months duration.

Tumor is hard, somewhat nodular, and seems to be beneath rectus sheath. At operation, tumor is found under the anterior sheath of rectus, and infiltrating the muscle. Pathological report: spindle-celled sarcoma.

At this point we would enter a brief commentary upon these five cases. Case I may or may not have been a desmoid. Neither the clinical findings, nor the operation note, make clear its point of origin, and it may perfectly well have been an ordinary subcutaneous fibroid nodule. It must bear the verdict "not proven." Case II similarly is not above suspicion. Whatever the nature of the primary growth, which was incompletely removed long before the patient sought the hospital, the recurrence in the scar certainly bears much closer resemblance to a keloid or sarcoma of the skin than to a true desmoid. As to the last three cases, we can undoubtedly regard them as cases for inclusion in the class of tumors under consideration. We would like to draw attention to Case V, as far as we know a unique example of true desmoid in the negro, contrasting strongly with the frequent occurrence in this race of the keloid, a tumor certainly very closely related to the desmoid.

Finally, we have to add to the cases here compiled, one which has recently occurred in our own clinic, and which led primarily to this review of the subject.

MRS. A. G., widow, aged 23 years, entered the hospital complaining of an abdominal tumor. Her family history is of no importance. The striking fact in her past history is the instrumental delivery of a still-born child, said to have been unusually large. This was the only pregnancy. The present illness began seven months ago, when patient noticed a lump in the left half of the abdomen. There has been no apparent growth since discovery. No pain or other subjective symptoms of any kind. On examination, the patient's general condition is excellent. No organic lesions. Patient quite stout. Abdomen is full, soft, with thick fatty walls. Nowhere tender. About 2 cm. to left of the umbilicus, there is an ill-defined, deep-lying, ovoid mass, measuring about 8 cm x 5 cm., with its long axis parallel to the fibres of the rectus. It is firm, smooth, and the skin over it is freely

movable. The mass itself moves with the abdominal wall. No apparent connection with the pelvis, or the internal genitals. Vaginal examination throws no light on the nature of the tumor. No other masses anywhere.

A definite diagnosis was not made. The very thick abdominal walls gave the impression that the tumor was intra-abdominal,—in fact it was partly so,—and the possibility of an omental or mesenteric growth, perhaps with adhesion to the anterior abdominal wall was considered.

At operation, the tumor was found to be a desmoid, arising from the posterior sheath of the left rectus, involving the entire thickness of the muscle, and the median two-thirds of its width. The greater mass of the tumor projected backward into the abdominal cavity, to such an extent that the bulk of the tumor was intra-abdominal, and was firmly adherent to the peritoneum. In excising the growth, a piece of peritoneum 4 x 5 cm. was removed with it. The abdominal contents were normal. Closure was effected in layers, and a strong repair made without the necessity of any plastic measures. Pathological report: very cellular fibroma.

In reviewing the cases above reported, with those collected by other authors, certain salient features have been observed in regard to desmoids, which are commented upon by all the writers on the subject. These characteristics we will proceed to outline, using Pfeiffer's work freely for statistics.

*Pathology.*—These tumors are of connective tissue origin and spring from the musculo-aponeurotic structures of the abdominal wall. In the gross they are hard tumors, occasionally with areas of softening from cystic degeneration; smooth or slightly nodular in outline; cut with a crisp grating, and on the cut surface present a dense fibrous structure. Microscopically the majority of specimens present the typical picture of a more or less cellular fibroma. In a certain number of cases, careful sectioning shows areas of sarcomatous change, and a few are pure sarcomata. Other variations occasionally met with are tumors presenting areas of myxomatous or

hemorrhagic degeneration. These facts have led to the use of various compound names, *i.e.*, fibro-myxo-sarcoma, etc., but the best authorities sustain the practice of Sanger who groups all these tumors under the one term desmoid. The former generally accepted belief in the rarity of malignant tumors of this class has been considerably modified by the statistics of Pfeiffer<sup>3</sup> in whose tabulation 10.6 per cent. of the cases in women and 24.4 per cent. of those in men were sarcomata. This large proportion of malignant cases in the male is worthy of note, as is also the curious fact, that the clinical and microscopic evidences of malignancy show less harmony in this class of tumors than perhaps any other. Tumors which show rapid growth, invasion of neighboring parts, and pain, not infrequently are pure fibromata; whereas, on the other hand, clinically benign, quiescent growths may present typical fields of sarcoma under the microscope.

*Incidence.*—The rarity of these tumors may be appreciated from the statistics of Guerlt, obtained from the Vienna hospitals, .13 per cent. of desmoids in 16,637 tumor cases. Perhaps the most striking peculiarity of the desmoid is the preponderance of its occurrence in women, and particularly parous women. Nor infrequently the tumor is first discovered during pregnancy or the puerperium. To have recourse again to Pfeiffer's figures, he shows that 87.1 per cent. of his cases were in women, and that 94.3 per cent. of the women had borne children. The tumors may occur at any age from 1½ to 81 years. In fact, a rare case or two, considered congenital, is on record. The period of life of greatest liability is from 25 to 35 years in women and 35 to 50 in men.

*Location.*—The most frequent position of desmoids is in the right lower quadrant of the abdomen. The anatomical structure from which they most frequently arise is the rectus abdominis muscle, or its attachments, sheath, lineæ transversæ, etc. Next in order of frequency come the external oblique muscles, the fascia transversalis, and the lineæ alba. A characteristic of the tumors, which are usually ovoid, is that their long axes are nearly always parallel with the direction of the

fibres of the muscle in which they are growing, so that desmoids in the middle of the abdomen lie longitudinally, whereas those in the flanks are transverse. Nélaton<sup>2</sup> believed that these tumors frequently originated from the bony pelvis, and that most of them were connected with it by a fibrous pedicle, but Guyon<sup>12</sup> has shown that such a connection either does not exist at all, or is simply a band of fascia under tension. Desmoid tumors are solitary; at least, multiplicity has never been proved.

*Etiology.*—The peculiarities of desmoids have led to much speculation and discussion as to whether they may not have some special causation aside from those factors that may lead to tumor growth elsewhere. The fact to which attention was drawn above, namely, that pregnancy seems to bear some relation to the incidence of these neoplasms, and the further fact, that many cases occurring in men or nulliparous women, give a history of preceding trauma, has furnished ground for much speculation. Herzog<sup>13</sup> and others support the theory that during pregnancy or parturition there is a rupture of the structures of the abdominal wall that leads to a fibrous scar or a hematoma. This scar or organizing hematoma is conceived to be the starting point of a desmoid, in much the same way as a skin scar is the starting point of a keloid. Others have supposed that the stretching of the muscles of the belly-wall during pregnancy plays an important part in the process, and explain the striking absence of desmoids in cases of distention from ascites, ovarian cysts, etc., on the ground that in these conditions the blood-supply to the abdomen is impaired, and the general nutritive resources of all the tissues is low, whereas in pregnancy, just the reverse is the case. Certain experimental work on pregnant and ascitic animals lends color to this reasoning. But while pregnancy may present favorable conditions for desmoid formation, the not infrequent occurrence of such tumors in cases with no history of either pregnancy or trauma, makes it probable that there is some other more important factor in the etiology, and the general belief is that the cause of desmoids will be explained only

when the mystery, that as yet enshrouds neoplasms in general, is finally solved.

*Clinical Course.*—In the majority of cases, the patient accidentally discovers the existence of the mass. Pain or subjective symptoms of any kind are unusual; if the growth be quite large, there may be dragging, aching sensations, or the tumor if large and properly situated may give rise to visceral disturbances from pressure, the bladder being the organ most frequently involved. The tumors, when first discovered, are usually from about the size of a hen's egg to that of a clenched fist. In most cases growth is slow, possibly imperceptible. Calcification may put a stop to the progress of the tumor. In some cases, however, growth may be quite rapid, the tumor reaching the size of a child's or even an adult's head in a few months. Recession and spontaneous disappearance of a true desmoid has never been observed. The larger tumors, particularly if projecting anteriorly, are liable to traumatism or friction from the clothing, and as the skin over them is tense and thin, with dilated veins, conditions favorable for ulceration exist. When this occurs, a portal of entry for infection is of course opened, and death from this cause is a well recognized termination of large desmoids.

The lymph glands usually are not involved unless the tumor is of a most malignant type. As has been stated above, clinical indications that suggest malignancy, such as recurrence after apparently complete removal, or invasion of surrounding parts, may occur in tumors microscopically benign. It should be noted in passing that such "invasion" is really rather a pushing aside of the neighboring tissues, since although these tumors seldom have a definite capsule, they are well circumscribed, and neither clinically nor microscopically tend to diffuse permeation of the tissues, except in cases of pure sarcoma. Let me again, however, call attention to the figures given above regarding the frequency of sarcoma, particularly in men, and emphasize the mistake made in the past of attributing so little possibility of malignancy to desmoids.

*Diagnosis.*—One would think there would be little diffi-

culty in recognizing these growths, and in many cases this is true; but where the patient has thick abdominal walls, and the tumor is deeply situated, it is by no means easy. A tumor springing from the anterior sheath of the rectus is usually easy to diagnose. Such a tumor, which is freely movable when the abdomen is relaxed, disappears or becomes fixed when the muscles are made tense by straining, or raising the head from the pillow without the help of the arms. From cases lying within the muscle, suppuration, hematoma, and cysts of various kinds have to be differentiated. The tenderness and other signs of inflammation usually render the first of these problems easy. Cysts may be diagnosed by aspiration, particularly if this possibility is suggested by fluctuation, which is not, however, always present in cysts. In deep lying hematomata with firm tense capsules the findings may be most confusing, but the fact that a hematoma either is absorbed or suppurates, whereas a tumor grows, will distinguish the two lesions if one has opportunity to observe the case for a time, or can secure a trustworthy history.

Lastly, and most difficult of all to diagnose, are those cases in which the tumors project posteriorly into the abdominal cavity. Here one has to consider the possibility of the tumor being of visceral origin, and if the walls be thick, palpation is most unsatisfactory. Tumors of the liver may be ruled out by the descent of that organ with inspiration. The spleen usually has a characteristic edge, but certain cases may be most confusing. Kidney tumors can usually be ruled out by the change in percussion and palpation following inflation of the bowel. Intestinal growths give rise to symptoms which are entirely unlike the desmoid picture, and are besides usually mobile and take up different positions. Finally, the rare tumors, especially sarcomata, of the omentum or mesentery, may present great difficulty, and indeed, if they are adherent to the anterior abdominal wall, the distinction may be impossible to make.

*Treatment.*—The question of what to do for these growths, may be answered in two words: *operate early*. The

not remote possibility of malignant degeneration in any tumor of this class is sufficient reason for such advice, but aside from this the direction of growth of many desmoids furnishes another strong reason. All of the cases which spring from the posterior wall and grow backward naturally become closely applied and adherent to the peritoneum. Furthermore, in their extension laterally they either cause pressure atrophy of the muscles, or push them aside. The longer such a condition lasts, and the further it extends, the larger defect is made both in the muscular and peritoneal layers, by the complete removal of the tumor. We have not space to describe the ingenious plastic methods employed in the closure of wounds by some of the surgeons who have removed large tumors; but we feel sure that one who has been forced to such resorts will afterward be a vigorous advocate of early operation. The chief factors that prevent perfect results are the occurrence of post-operative herniæ and recurrences of the tumor. That we may emphasize the gravity of the condition, we present the following statistics collected since the introduction of antiseptics.

Mortality in laparotomy cases.....	3.5 per cent.
Mortality without laparotomy.....	1.05 per cent.

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Recurrences in men .....	68.1 per cent.
Recurrences in women .....	90.0 per cent.

Final cure, surviving 1st and possibly 2nd and 3rd operations:

Men .....	50 per cent.
Women .....	21.2 per cent.

In conclusion, I wish to express my gratitude and appreciation to my chief, Dr. Watts, for his stimulating support in the preparation of this paper.

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## NOTE ON SYPHILIS OF THE LIVER.

WITH A REPORT OF THREE CASES IN WHICH OPERATION WAS RESORTED TO.

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ACQUIRED syphilis of the liver in its tertiary stage assumes three distinct microscopical types: First, when the eruption shows itself in the form of white milky patches, irregular star-shaped in form, due to an inflammation of the Glisson's capsule as first pointed out by Virchow. Second, single gumma, frequently large and usually on the anterior surface or along the anterior border of the liver. Third, multiple gummata which appears to be the more frequent form, varying in size from a small bird-shot to an English walnut.

As Rolliston says, "The right lobe is much more often affected, and the anterior surface far more frequently than the under aspect. In eighty-six cases of hepatic gummata collected by J. L. Allen, only eleven were single. It is said that the neighborhood of the falciform ligament is a favorable situation for gummata." But Rolliston has not noticed any such tendency except for the anterior surface.

The gross appearance of old gumma presents raised tumors irregularly nodular with three concentric zones,—the centre yellow and softened; the middle one whiter, more resisting, and elastic; the third or exterior, a fibrous shell.

The first form is perhaps the early manifestation of commencing sclerosis with which it is sometimes associated. Maurice describes this type as sclerogummata. The differential diagnosis between carcinoma of the liver and the larger gummata is often difficult. The syphiloma is smoother and not quite so nodular in feel, and is usually of a yellower color.

Primary carcinoma of the liver is rare; it is more rapid in its course, and the patient is usually sicker than with syphilis, and, as Cumston says, "Enlargement of the spleen favors

syphilis." Multiple gummata of moderate size may also closely resemble carcinoma in its secondary stage, while the smaller syphilides may at times resemble miliary tuberculosis.

Syphilis is sometimes mistaken for cirrhosis of the liver. In such cases hæmatemesis, dilated veins in the abdominal wall, ascites, and dyspepsia are less frequently seen than in cirrhosis. When ascites is due to cirrhosis the patient is thinner, while in syphilis the general nutrition may be fairly preserved. In cirrhosis, if the liver is enlarged, it is usually more symmetrical than in syphilis, for in the later condition there is usually an irregular enlargement. As the iodides are frequently given in cirrhosis, some of the reported cures of this disease may have been due to a mistaken diagnosis. In all three of these types the diagnosis may have to be settled by a course of antisyphilitic treatment or by the removal of a piece of the tumor for microscopical examination, as was done in two of the cases reported below.

*Symptoms.*—It is quite surprising how many of the fifteen cases of syphilis of the liver already operated upon and reported by Keene and Cullen give no previous history of syphilis, nor any of the ordinary evidences of tertiary syphilis aside from the liver condition itself. In most of the reported cases the statement is made that they have not had the ordinary primary or secondary symptoms of syphilis; that they have not had primary sores, skin disease, falling of the hair, chronic sore throat, rheumatism, and that there is no enlargement of the glands. It seems to me that there are two possible explanations,—the first, that there are so many extra-genital primary sores which are not recognized as syphilitic; and, second, that the cases giving the ordinary symptoms have been properly diagnosed and treated, thereby preventing the later liver symptoms; or, if a certain case has had the ordinary primary and secondary symptoms, the later tertiary liver troubles will be much more easily diagnosed and the proper treatment instituted, thereby avoiding, perhaps, the necessity of an exploratory operation.

Of the cases which have come to operation, many have

given only slight symptoms of any kind. The patients have looked well and have only suffered mild distress in the epigastric region; there has usually been a jaundice for several weeks with a temperature of about 100° F., loss of flesh, and some enlargement of the liver. In several with a distinct tumor which felt like an enlarged gall-bladder, and in a few with a small ascitic accumulation. Many of these cases have had colic, like biliary colic; and if associated with enlargement and tenderness in the gall-bladder region, it is not surprising that they have been mistaken for gall-bladder cases.

*Treatment.*—If syphilis of the liver is suspected, a course of antisyphilitic treatment, especially large doses of the iodides, should be given, and will cause a cure in a large proportion of cases. From fifteen to thirty grains of the iodides of potassium and sodium t. i. d. combined with mercurial inunctions, or, in acute cases, intramuscular injections of the mercurial salts. But, in spite of large doses of the iodides, some cases of large gummata will not disappear. Such cases are recently reported by Mr. R. Parks and Dr. Garrod.

This brings us to the question of the operation. Auschultz and Hans Kerr think that even after exploration, if syphilis of the liver be found, the wound should be closed and the patient be put upon antisyphilitic treatment. This position is undoubtedly correct in all cases except where large gummata are found, for these are the cases which persist in spite of treatment. My own experience, when viewed in the light of the reports made by Keene, Robeson, Mayo, and Freeman in removal of large tumors of the liver of various kinds, makes me feel that the surgery of the liver is just commencing, that it is a fruitful field, one that we have shunned on account of the fear of hæmorrhage; that many of the tumors of the liver which we have universally abandoned can be safely removed to-day.

Hunbald reports ninety-six cases of resection of the liver, being all of the cases reported in the literature that he could find, with a mortality of 26 per cent. This includes Keene's list with a mortality of 15 per cent., while Cullen, who has

tabulated all of the cases since Keene's reports finds seventeen with two deaths, or a mortality of 11.7 per cent. But to return to the surgical treatment of gummata: I find ten cases of either complete or partial removal of large gummata, including my own case, with two deaths, both of these deaths were treated by the elastic ligature method, making a mortality of 12.5 per cent.

The removal of gumma helps in the cure of any case because there is much less tissue to be absorbed. If antisyphilitic treatment was certain to absorb all gummata, then the risk of removal would not be justifiable. But as it will not always absorb large gumma, and as the diagnosis is not always certain from gross appearance of the growth, removal is justifiable.

Keene favors the removal of tumors with a red-hot cautery knife, tying the large vessels separately with catgut. Mayo reports one case successfully treated in this manner. The constriction of part of the liver with an elastic ligature behind hat-pins has been successful in a few cases, but is also responsible for some of the late deaths. Konsnietzoff's blunt needle with double catgut, as used by Mikulicz, is perhaps the best method of controlling the hæmorrhage after removing the tumor. Gauze tamponing of the raw surface, especially after the use of the cautery, is an additional precaution in preventing hæmorrhage.

CASE I.—A patient seen in consultation with Dr. Herbert Davis. This man was forty years of age, who denies syphilis, and has not had, nor does he give now, any signs of syphilitic infection. He had been suffering with indefinite pains through the right upper abdominal cavity, with a moderate enlargement of the liver, first noticed six weeks ago. He had been suffering with attacks of colic for the past three months, with some loss of flesh and strength. On exploration, December 12, 1903, I found an enlarged liver, its upper surface covered with white star-shaped patches, while its under surface presented several hard, white nodules from the size of a plum to a pea. One moderate sized nodule near the anterior surface was removed and the wound sutured with catgut, the end of a gauze drain being attached to

the liver. Two microscopical diagnoses were made, one for carcinoma and one for gumma. After exhibition of the iodides, the enlargement of the liver disappeared, and the man gained twenty pounds in three months. As he has remained perfectly well, now over two years since the operation, it is reasonable to conclude that the diagnosis of carcinoma was not correct.

CASE II.—Large gumma of the anterior border, operated upon four and a half years ago. Mrs. B., seen with Dr. Jeanette MacLaren in December, 1900; thirty years of age; mother of three healthy children, aged seven, six, and three, respectively. These children show no evidence of hereditary syphilis, but are not a very vigorous type. Five years before was treated by Dr. Schadle for some throat trouble; after operation, which I am here describing was performed, it was discovered that at this time she had a perforation of the soft palate, which quickly healed after a course of iodides. One year before I saw her, Dr. Charles Greene treated her for pulmonary tuberculosis. Tubercule bacilli were found in the sputum. Under treatment, her weight improved in three months from 107 to 120, and the tubercle bacilli disappeared from the sputum. Dr. MacLaren had treated her for chronic pelvic disease and general anæmia, which always promptly responded to local treatment and Blaud's pills. The abdominal growth was first noticed in August, 1900, which was not tender at any time. In October she became quite anæmic, although the blood was not changed; red corpuscles normal; no increase of white cells. Temperature was from 100° to 101° F.

Operation, December 6, 1900. A large white tumor on the anterior border of the left lobe, overlying the gall-bladder, the size of a man's fist, not pedunculated, extensive adhesions to the omentum. This tumor was removed, with at least one inch of normal liver substance, with a knife after an over and over catgut suture passed with a large, curved, round pointed needle constricting the same tissue more than once, when it showed a tendency to bleed. Iodoform gauze-drains were packed against the large raw surface left after removing the growth. This woman promptly recovered, and has remained perfectly well, now four and one-half years since the operation. She has had iodides since the operation on several occasions. Dr. Westbrook diagnosed gumma.

CASE III.—Mrs. L., seen with Dr. Sweeney. Patient is

thirty-six years of age; married sixteen years. Soon after marriage she had an attack of inflammation of the womb; was a patient of Dr. Sam Johnson, of Hudson, and was treated by him for several years at his sanitarium for chronic pelvic trouble and a chronic cough. Her first child was born dead, but was perfect and not apparently diseased. Later she was quite well for seven years. The second child was born six years ago, and has always been a healthy child. Present trouble commenced two years ago with pain in the region of the stomach and occasional attacks of vomiting and chronic soreness in the epigastric region. She has never had any symptoms suggestive of syphilis. Five weeks ago she first noticed a lump just above the umbilicus, continuous with the edge of the liver. Exploration on April 7, 1905, demonstrated a uniformly enlarged liver, covered with hard, white, irregular nodules, each about the size of a silver half-dollar. Fully thirty such nodules were seen and felt in both lobes, equally distributed in both the upper and under surface of the liver. No larger mass was found in the abdominal cavity. A section of one of these lobes was removed and the cut edges were united with catgut sutures. There was a very slight accumulation of ascitic fluid. This woman recovered promptly, and left the hospital improved under iodides, but with some ascitic fluid in the abdomen. She has gained fifteen pounds; ascitic fluid had decreased.

Dr. Hines and Dr. Rothrock report that the growth is a gumma.

## PRIMARY CARCINOMA OF THE VERMIFORM APPENDIX.

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THE relative rarity of primary carcinoma of the vermiform appendix, compared with its rather frequent occurrence in other parts of the viscera, is sufficiently striking to make every case of sufficient interest to record.

*History.*—The vermiform appendix seems not to have been recognized as the possible seat of primary carcinoma, until Merlin, in 1838, first described a case. From this time it began to be referred to in literature, the older writers holding the opinion that neoplasms of this body were always secondary. Prien, in 1865, recorded one case, and two years later Rokitansky reported four cases of colloid tumor of the appendix. Up to 1895, but twelve cases had been reported, and out of this number one only had been histologically described; seven of the total number were discovered post-mortem. During the past ten years the number of cases reported has been greatly augmented. In 1903 forty cases were collected and reported to the New York State Medical Society. There are now on record about sixty-one cases that appear to be undoubted instances of primary carcinoma of this body; nineteen of these cases have not been confirmed by pathologic examination; there are also eight instances of primary sarcoma. While the classifications of the malignancy of some of the cases reported were undetermined by microscopic examination, they conform so closely to the description of those that have been studied, it is, I think, logical to place them in the same category.

*Clinical History.*—There is a striking absence of that chain of symptoms that goes to make up the picture of malignancy as usually met with. The most noticeable is the very

early age at which it has been found. The youngest was a girl of 12 years and the second was a girl of 15 years, while none seem to have been found in subjects past 40 years. Females are more often subjects of this malignancy than males. The patients are attacked with symptoms identical with those of the inflammatory type of appendicitis and the course of the attack throughout in no way differs from it except in the marked lessening in acuteness of the majority of the symptoms in by far the greatest number of cases, while on the other hand a few instances are recorded which serve to illustrate the possibilities of most acute symptoms. These are shown in a white girl 17 years of age, whose second attack came on after an interval of one year, with unusually severe pain, nausea and vomiting. With few exceptions the course of the attack is chronic, recurring at intervals of months or weeks; one of them extended over a period of seven years.

In but two instances has the neoplasm been associated with suppuration, and in one case of this type operation was done during the second attack, which was three weeks after the first had been complained of; the appendix in this case was acutely inflamed and the lumen contained pus.

In a number of instances the attack has been ushered in with no graver symptoms than those usually described as "acute indigestion" without any increase in temperature or pulse rate beyond normal, the extent of subjective symptoms in some cases being limited to pain only on deep pressure. The objective symptoms, however, in many of the cases, seem to be distinctly suggestive, there being noticeable evidence of impaired nutrition and assimilation, as shown in general anemia with some loss of flesh and pronounced lassitude, without any particular noteworthy change in the pulse rate or temperature, though the striking absence of classic constitutional symptoms, such as cachexia, has not even led to the suspicion of the nature of the disease before operation. This leads to the belief that malignancy of this organ *per se* does not carry with it any clinical symptoms that will define its true character. Probably the most misleading factor in the clinical

history is the varying periods at which recurrent attacks have been reported. One case, for example, a female aged 30 years, had recurrent attacks which extended over a period of seven years, while in another case, also a woman, 24 years of age, the illness dated but two days, while in still another case, that of a colored boy, aged 19 years, the only symptoms were repeated attacks of abdominal cramps.

*Ætiology.*—It seems probable, both from the study of the recorded cases as well as observations made by myself in this single instance, to regard these malignant changes in the appendix as secondary to the catarrhal form of inflammation, and that the transition from the simple inflammatory conditions to that of malignancy is not marked by that chain of symptoms usually described as belonging to primary malignancy.

Arguing, therefore, from analogy and from the well-known association of carcinoma with chronic inflammations, and commenting upon the rarity of tumors of the appendix, as compared with the frequency of its inflammatory affections, it seems logical to conclude that neoplasms of this organ are in a greater number of cases secondary to simple inflammation, especially should this be true in the milder forms of appendicitis, but it could not hold good in those acute inflammatory ones which culminate in abscess. In several of the recorded cases there was a definite stenosis which seems to have been a primary factor.

*Symptoms.*—The fact that carcinoma has been found in this body in persons dying from disease other than that of the appendix, clearly emphasizes the fact that neoplasms may exist in this organ without producing any symptoms directed toward it. Not only are the symptoms during the attack atypical but at no time throughout its existence does it develop any tangible evidence of its true nature. The attack is usually ushered in under precisely the same conditions and in like manner to that of the milder inflammatory forms. The patient will complain of diffuse pain, localizing itself to the right iliac fossa, nausea and vomiting, some soreness, most

pronounced to the right of the hypogastrium, rigidity and palpable tumor, with the usual history of recurrence and with intervals of freedom from symptoms, together with a decided variance in pulse and temperature record.

*Gross Pathology.*—The appendix, as in the ordinary inflammatory forms, is more often than not adherent at some point to the parietal peritoneum or to the intestines, more often at or near its tip. It is also greatly enlarged, dumb-bell shaped, and at its distal end is fibrously hard, considerably enlarged and definitely circumscribed, so much so that it may readily be mistaken for a small fibroma; it cannot be shelled out, and in places the margins generally merge into the surrounding tissues. The cecum, the ascending colon, and the ileum have been found to show decided inflammatory changes. In a few cases the mesenteric glands were found to be of unusual size. So greatly enlarged were they in one case that the anatomic diagnosis was tuberculosis; the external surface of the neoplasm is generally very smooth and rather devoid of appearance of acute inflammation.

The appendix in one case reported, that of a girl 14 years of age, was twisted upon itself and firmly bound down, presenting two constrictions between which was a round nodular neoplasm about the size of a small marble, yellowish-white in appearance. Again the tumor may be small, acutely inflamed, and the mucosa deeply ulcerated, with the lumen of the appendix obstructed by the growth. In some cases it is more or less spheroidal, and in one instance it was found the size of a sickle pear and not unlike it in shape. In none of the cases has ulceration to the extent of perforation been noted.

Carcinoma of this part of the body seems to seldom, if ever, give rise to secondary deposits, as the literature does not record a single instance of metastasis. In all cases in which locations of the growth have been referred to they are shown to be situated at or within four or five millimeters of the tip. This observation holds good for more than half of them, indeed, in only eight or ten cases was it found near the cecal

end, while in one case only was it found that the neoplasm extended within the cecum. The original focus of this one was, however, demonstrated to have had its origin in the appendix. The size of the growth varied from 5 to 15 millimeters.

*Diagnosis.*—From the history of this condition it is obvious that the diagnosis cannot be made until operation and microscopic examination has been made. It is, however, just possible to strongly suspect the true character of the condition, if in a young subject there has been repeated acute attacks more or less insidious extending over a period of months or years, with decided loss of body weight and strength and with abdominal walls sufficiently thin to enable a fibrous hard tumor to be outlined, thought should be given toward its malignant nature.

*Prognosis.*—Every case operated has made perfectly normal recovery after the removal of the neoplasm, with restoration of the body weight and strength.

**CASE RECORD.**—The subject of this report, Patrick G., was an adult male aged 35 years with negative family history, referred to me by Dr. Stewart Runkle while suffering in his eighth attack, the first of which dated back 13 months.

The attacks during these intervals had recurred from 1 to 3 months apart, though the patient complained that he was never at any time since the first attack entirely unconscious of the existence of pain or discomfort in the right side of the abdomen and especially was this annoying after taking food. He also had with these attacks occasional vomiting, with periods of constant nausea, some elevation of temperature, with little or no increase in pulse rate, and obstinate constipation. The abdomen was distinctly scaphoid, the peristaltic wave was readily discernible through the thin abdominal wall with possibly slight convexity over the right iliac fossa.

Deep palpation was necessary before any tenderness could be elicited. A small hard pulsating mass could be readily outlined on deep palpation.

Urinalysis negative.

Operation July 30, 1907, under ether anaesthesia. The

abdomen was opened through a right lateral incision  $2\frac{1}{2}$  inches in length over the usual site. The omentum and intestines visible through the incision were apparently in every way normal, on passing beneath them a stony-like, definitely circumscribed mass could be readily felt, which was so firmly anchored to the parietal tissues directly across the external iliac vessels, that their pulsation transmitted to the finger, over the growth, an impulse at first not unlike that of aneurysm. There were no mesenteric gland enlargements, the surrounding tissues seemed entirely free from demonstrable inflammatory change. It required the most painstaking dissection with the fingers to separate the appendix which was adherent about  $1\frac{1}{4}$  inches from its tip over the sheath of the vessel. Once freed it was readily brought out through the incision enabling the work of completing the operation to be done outside of the abdomen.

The gross appearance of the tumor is as follows: It was  $1\frac{1}{8}$  inches in length, beginning  $\frac{1}{4}$  of an inch from the tip and extending toward the proximal end for a distance of  $1\frac{1}{8}$  inches, pyriform shape and  $4\frac{1}{8}$  inches in circumference, fibrously hard, giving to the sense of touch a distinctly fibrous feeling. The surface was smooth, and save for the site of adhesion to the vessel, was free from roughness. The various layers of structure composing the growth were firmly adherent one to the other down to the mucosa, this latter was in no way connected, though it had undergone an independent thickening so extensively as to stand out like a quill and almost as firm, the neoplasm could be withdrawn and replaced over it with the same ease that the piston of a syringe can be moved backward and forward within its barrel.

The proximal end of the appendix for about  $\frac{1}{4}$  of an inch was in appearance entirely free from involvement and with the exception of the adherent surface the entire organ was smooth with a grayish-white or ground-glass color. The stump was ligated and pushed into the colon. The serous coat was sutured, and the abdominal incision closed. The recovery was uneventful. The patient left the hospital on the fifteenth day. A visit from him two weeks ago showed improvement both in body weight gain, and general nutrition.

*Anatomic Diagnosis.*—Chronic interstitial appendicitis.

*Pathologic Diagnosis.*—Infiltration carcinoma.

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## HERNIA OF THE APPENDIX, COMPLICATED WITH APPENDICITIS.\*

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NOTWITHSTANDING the subject of this communication is of but minor importance, the comparative infrequency of hernia of the processus vermiformis ought to justify the report of every case encountered.

It may be argued from the practical standpoint that it is of no importance to the surgeon or the patient to know beforehand what is contained in the sac of a hernia, that the operation is the same no matter what the condition. This is to be granted if we allow that the office of the surgeon has no aim beyond the ability to do an operation and dispose of the ordinary complications to be dealt with. But, as the principles of medicine are being more and more crystalized into a science, diagnosis naturally assumes a higher place in the mind of the surgeon, besides the world has always expected us to understand things which we undertake.

The diagnosis of hernia of the appendix will always be surrounded by difficulties, but bearing in mind that such a thing is possible and having a knowledge of the phenomena attending the condition, it will in most instances be possible to make a probable diagnosis.

When the processus vermiformis is inflamed in the sac of a hernia the clinical picture is that of strangulated enterocele minus the obstruction that usually attends the latter. In differentiating hernia of the appendix with inflammation from strangulated enterocele, it is well to remember that in the former the symptomatic syndrome is that of an inflammatory condition while the phenomena of obstruction predominates in

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\* Read before the Western Surgical and Gynecological Association at St. Louis, Dec. 31, 1907.

the latter. Levy lays stress upon pain felt about the umbilicus. In my own case there was great pain in the right iliac region. The form of the sac is alantoid, excepting when the appendix enters the canal doubled upon itself. An epiplocele may have the same appearance but is usually not so distinctly fusiform. The appendix in the hernial sac may be mistaken for an inflamed gland. The percussion note in both omentocele and hernia of the processus vermiformis is dull. No age is exempt from hernia of the appendix vermiformis, but it has been observed far more frequently in the aged and more often in the male sex. The appendix has been found more often in right inguinal than in crural hernia. This probably accounts for its greater frequency in the male sex. It has been found in left-sided hernia. The appendix may occupy the sac of congenital as well as that of acquired hernia.

Levy has raised the question as to whether inflammation of the epityphlon is the result of incarceration or whether the incarceration is due to inflammation and consequent swelling of the organ. He inclines to the belief that inflammation precedes incarceration.

It is said that an attack of epityphilitis predisposes to hernia of the appendix. The causes of appendicitis in the herniated organ are the same as the causes for inflammation in the organ *in situ naturalis*. It must be remembered, however, that trauma is infinitely more frequent in the herniated than in the appendix in its normal situation. As before stated, by far the greater number of cases of inflammation of the herniated appendix occur in aged patients. Levy accounts for this on the hypothesis that rheumatism predisposes to the formation of calculi and that diminished peristalsis in the aged prevents the appendix from emptying itself as rapidly as in youthful patients. This authority gives the causes of inflammation of the herniated appendix as traumatism, concretions, foreign bodies and digestive disturbances.

Perityphilitis may give rise to a serous effusion into the sac. Grave cases may be complicated with peritonitis or even

phlegmon. Perforation is frequent. According to Levy, one of the capital symptoms of appendicitis in the sac of a hernia is pain of a sticking and paroxysmal character always felt with greatest force in the same place. Sometimes there is a radiating pain directed from the inner inguinal opening toward the abdominal cavity. The tumor enlarges rapidly. Sometimes there is crepitation. The general manifestations are acceleration of the pulse and sometimes vomiting with elevation of the temperature. In the gangrenous form the temperature may be low. Levy makes the statement that vomiting is more frequent in simple incarceration of the appendix than in appendicitis. Peritonitis beginning in the herniated appendix may rapidly become phlegmonous.

In the differential diagnosis simple incarcerated hernia is first to be excluded. In epityphilitis hernialis as contrasted with strangulated enterocele the inflammatory phenomena predominate. Vomiting is less frequent and obstruction of the bowel is not often present, while the general appearance of the patient is not so grave. The diagnosis is always beset with uncertainties. Bichat observed the possibility of suppurative infection spreading from the epityphlon *in situ normalis* to the hernial sac and vice versa from the hernial sac to the general peritoneum. Bichat reports a case of his own and cites another from Körte in support of this statement.

Hydrocele may exist with hernia of the appendix and perforce with appendicitis hernialis. The wearing of a truss over a herniated appendix is fraught with dangerous consequences. Taxis is to be avoided under all circumstances.

Levy observes that the operation is to be determined altogether by the condition in which the appendix is found upon opening the sac. The appendix must be liberally exposed and resected if possible and the wound closed so as to cure the hernia. In the presence of phlegmon or suppuration this cannot be done any more than we would close the abdomen after an operation for suppurative appendicitis. In the presence of phlegmon or suppuration

in the hernial sac drainage must be employed. If an active phlegmon is encountered Levy counsels splitting the appendix and drainage until the sloughing and infection subside when the clean radical operation is done. Jonathan Hutchinson, Jr., who wrote upon this subject in the *British Medical Journal*, Oct. 21, 1899, holds about the same opinion.

One of the latest studies of this subject is the thesis of Jacquemin at Paris, 1905. He does not confine his reports to cases of hernia of the appendix alone, but includes all cases of hernia in which the appendix is present. This authority looks upon strangulation of the appendix as being very rare, excepting where the organ has prolapsed into the canal doubled upon itself. He agrees with all other authorities regarding the influence of old age on hernia of the appendix, but admits that no age is exempt from the accident. He mentions the fact that a hernia with painful crises or one with an unusual history ought to be suspected as containing an appendix. He calls attention to Demoulin's two cases of hernia of the appendix complicated with sacculated cysts, giving to the case the aspect of hydrocele of the cord. He likens appendicitis herniare to appendicitis in other unusual locations. The difficulty of diagnosis is increased because appendicitis in a hernia is not very different from what sometimes takes place in an ordinary hernia strangulated or inflamed. He regards the prognosis as good excepting in neglected cases. Jacquemin tabulates fifty-eight cases with six deaths, most of which were due to procrastination. He shows how the attendant may be misled by the insidiousness of the onset and the simulation of the disease to epiploitis.

John G. Sheldon published a paper on this subject with report of a case in *American Medicine*, 1903.

Bull and Coley observed the appendix in right inguinal hernia sixteen times in a thousand cases.

R. Peterson found the condition twice in ninety right hernias.

Hutchinson is responsible for the statement that an attack

of appendicitis predisposes to hernia of the appendix. He describes certain changes in the organ due to inflammation that facilitated its entrance into the inguinal canal. He states that a hernia containing an appendix is usually irreducible and tender on deep pressure. If the appendix is found in a normal condition at the operation he advises returning it to the abdominal cavity.

REPORT OF CASE.—H. W., German farmer, living near Yates Center, Kas.; he had been the subject of an inguinal hernia of the right side for several years. The hernia had often been painful. He had worn a truss. He was referred to me for operation by Dr. Maxon, of Toronto, Kas., August 17, 1907. He entered St. Francis Hospital the same day. According to the statement of the patient he had felt ill eight days before and had called a physician on the fifth day previous. This physician employed taxis persistently, and failing to reduce the hernia, told him to remain in bed and employ liniments. Three days later, feeling much worse, he summoned Dr. Maxon who recognized the condition and advised operation. The operation was done on the evening of the seventeenth day of August, the same day of admission to the hospital and the eighth day after the attack.

Inspection revealed a sausage-shaped mass in the right inguinal region extending from the external ring to the testes in the scrotum. Palpation showed the mass to be smooth, hard and tender on pressure. The tenderness extended to the right iliac fossa. The patient looked sick and was hiccupping slightly. The bowels were not obstructed. An incision was made over the tumor, the upper and outer limb of which corresponded to the Bassini incision for hernia, and the lower part was extended over the cord into the scrotum. Upon opening the sac a small quantity of foul-smelling fluid escaped. The appendix, enormously enlarged and discolored and adherent constituted the contents of the sac. The walls of the sac were very much thickened and adherent to the cord and the testicle. Upon dissecting up the appendix the head of the caecum and the ilio-caecal junction formed an infundibuliform projection into the upper part of the canal so that the entire processus vermiformis lay in the sac.

The caecum and ilium were adherent about the entrance to the canal. The appendix was resected close up to the caecum and the sac of the hernia dissected away. As much of the wound as possible was closed, as in the Bassini operation, but, deeming it absolutely necessary to employ drainage, a cigarette the size of the little finger was carried down to the stump of the appendix, thereby making the closure of this part of the wound defective. The drainage was removed entirely at the end of a week and the wound healed.

J. M. ELDER, in the *Montreal Medical Journal* of March, 1901, reports a case of appendicitis herniare with perforation, in an infant seven months old, operated, with recovery.

BÄILLET, of Orleans, France, *Revu de Chirurgie*, page 294, 1904, reports the case of an infant of thirteen months on which he operated for appendicitis herniare with satisfactory result.

LEURET reports a case of appendicitis in the sac of a hernia in a child of three years.

BARTH, cited in *Jahresbericht*, 1902, page 811, reports the case of a woman of eighty years whom he operated upon for gangrenous appendicitis in the sac of a hernia eight days after the onset of the disease.

FRÄNKELS, *Jahresbericht*, 1902, page 811, reports a case of herniated processus vermiformis in which the organ contained a fish-bone penetrating the mucosa. Estienny, in the same volume and page, reports a case. Dutoit, on page 811, *Jahresbericht*, 1902, reports the case of a woman of fifty-two years with partial obstruction and gangrenous appendix, with rupture in the hernial sac.

SOULIGOUX, *Jahresbericht*, 1902, reports a case of appendicitis in congenital hernia with a knuckle of bowel.

RUTHERFORD reports a case of a woman of seventy-nine with appendicitis in a crural hernia.

GALTEN reports a case of appendicitis in the canal of a hernia.

KÖLLIKER reports a case of a sixty-nine year old woman with appendicitis herniare, *Jahresbericht*, 1902, page 807.

MOUCHET, *Jahresbericht*, 1901, page 623, reports a case where an old hernia manifested signs of strangulation which was found to be due to an inflamed appendix present in the sac.

GOEBEL, *Jahresbericht*, 1901, page 623, found a perforated appendix in the sac of an hernia.

STECCHI, *Supplemento Al Policlinico*, April 14, 1900, reports a case of appendicitis herniare.

CALVINI, *Clinica Chirurgica*, 1902, No. 1, reports a case with operation and recovery.

COMINACINA, *Supplemento Al Policlinico*, 1902, No. 34, reports a case of appendicitis herniare with peritonitis-operation and recovery.

WULFF, page 757, Jahresbericht, 1902, reports a case of appendicitis herniare. Mires on the same page reports a case, while two cases are reported by Condamin. Racoviciccano reports the case of a man of sixty-five with suppurative orchitis with appendicitis in the hernial sac. Quenu, Jahresbericht, 1905, page 599, reports the case of a woman of forty-two in which the appendix was strangulated in a hernia. The portion of the appendix distal to the strangulation was in a state of inflammation: operation and recovery. Bichat reports a case cited on the same page with fatal termination. I do not believe any of these cases were included in the 116 tabulated by Bajardi and Briancon.

## ENORMOUS ENDOTHELIOMATOUS CYST OF THE GREAT OMENTUM.

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TRUE cyst of the omentum is of exceedingly rare occurrence, in fact, an exhaustive search of the literature has brought to light but nineteen cases. The Index Catalogue and the Index Medicus in the library of the Surgeon General's office contain thirty-four reported cases, but these have to be very carefully sifted out in order to obtain the cases of what I term true cyst of the omentum,—*i.e.*, cyst of the omentum itself. Twelve of these on careful analysis prove to be cysts springing from the omentum; attached to it by a pedicle or otherwise connected with it.

True cyst of the omentum is a cyst *within the cavity of the omentum*, lies entirely within its folds, and is not external to it in any way. A cyst springing from the omentum by a pedicle or connected to it in such manner as to show that it is clearly of it, is undoubtedly an omental cyst, but of an entirely different type from that serving as the basis of this paper. In fact, up to the present time, no one seems to have separated the cysts occurring *within* the cavity of the great omentum into a class by themselves as distinct from those wholly or partially *external* to the omental pouch. That this distinction should be made seems imperative, as the etiology of the one can be very distinct from the etiology of the other, as witness that of my case in which an omental endothelioma within the omental pouch was the beginning, and one of the external type in which an escaped ovarian cyst that had attached itself to the external border of the omentum is supposed to be the origin.

True omental cysts therefore are of sufficient rarity to

merit attention whenever found. Fort (*ANNALS OF SURGERY*, 1907) reports a case which he considers to be the twenty-third on record, but according to my researches he has evidently admitted four cases not entitled to be classed as of this type, and his is really the nineteenth; the case I shall report making the twentieth.

The condition was called to the attention of the medical profession in 1851 by Gairdner, who reported the first case, but advanced nothing to show the etiology. Later, in 1885, Doran<sup>1</sup> asserted that dermoid cysts of the omentum were really ovarian cysts that had become separated from their pedicles, and mentions the case of a small, soft, white body found adherent to the posterior aspect of the omentum with a pedicle about four inches long which proved to be the left Fallopian tube, the soft white body being the ovary. He thinks the ovary had become displaced; the stretched tube and ligament would in such a case be bound to atrophy and the tumor get its blood supply from the omentum. He admits that this could not always be the case, as dermoid abdominal tumors have been met with in males for which he advances no explanation. Jacobi,<sup>2</sup> writing of omental tumors as a class, says: "Nearly all of them, perhaps all, are of lymphatic origin, and result either from dilatation of lymph veins or from a cystic degeneration of lymph-nodes." Rokitsky<sup>3</sup> describes such. Weichselbaum<sup>4</sup> reports a case of the first variety and Sabourin & Le Dentu<sup>5</sup> another that contained chyle. A case of the second variety is reported by Werth<sup>6</sup> and by Duearkler.<sup>7</sup> Werth's case was a cyst as large as a child's head, rising from a segment of the mesentery of the small intestine (singularly enough, much difficulty was met with at times in telling whether the author meant cyst of the *mesentery* or of the *omentum*). There were no formed elements. Rokitsky explains it as a cystic degeneration of lymph-node caused by a primary obliteration of vasa efferentia, while the entrance of chyle not being impeded must lead to retention and dilatation. A similar cyst has been described by Eppinger,<sup>8</sup> who erroneously supposed it to be a dermoid, three of which have been

reported, one each by Waldy<sup>9</sup> and by Lipscher<sup>10</sup>—both external to but attached to the omentum; while Bonfigli<sup>11</sup> reports one contained within the cavity of the omentum itself.

The accompanying abstracts give a brief outline of each case of true omental cyst, while Table I, arranged in chronological order, is open to considerable analysis (fractional percentage not given).

#### ABSTRACTS IN BRIEF OF REPORTED CASES.

CASE 1.—GAIRDNER. The cyst was found beneath the anterior layer of the great omentum in a woman dying unexpectedly, having a large fibroid uterus. It consisted of a large closed sac, and contained a transparent, colorless serum.

CASE 2.—SIMON. Male, 44 years of age. Tumor could be felt in the right hypogastric region simulating a distended bladder. This tumor dated twelve years back but had never been painful. Catheterization brought only a little urine, and the catheter could be felt impinging against a resistant mass. Death five days after admission. Autopsy showed a tumor in the folds of the great omentum extending from the stomach to the upper part of the pelvis. It had a distinct thick-walled capsule, and contained much coagulated blood. It could be traced to no abdominal organ.

CASE 3.—JONES. Male, aged 58; farmer. Had always enjoyed excellent health. First complained two years previously of pain in the back and frequent micturition, with a feeling of weight and oppression in the bladder. He was relieved of these and not seen again for a year. Distressing nausea and vomiting with other dyspeptic symptoms were now complained of, together with renewal of the old symptoms. A small tumor was made out in the left hypogastric region which grew rapidly, and the man died. Autopsy: An enormously enlarged abdomen from ensiform cartilage to pubes; adhesions everywhere. A large cyst was found evidently originating in the omentum. It contained a broken-down sarcomatous mass weighing 15 pounds; also about 3 gallons of fluid. Lymphatic glands not enlarged. Tumor was an alveolar sarcoma.

CASE 4.—DORAN. Patient was a woman aged 58. Had suffered for many years from symptoms resembling cystic ovarian disease. Two years previously cyst had ruptured and filled again; had been tapped several times. Large cyst was found at operation intimately adherent to the parietal peritoneum near the umbilicus, and was entirely within the omentum. Recovery.

CASE 5.—GOODING. Girl, aged 19. When 18 years old she first noticed a lump the size of a hen's egg low down in right iliac fossa, which was painful chiefly at menstruation. It grew in size gradually upward. At time of observation it was as big as a cocoanut and reached

## ENDOTHELIOMA OF OMENTUM.

TABLE.

	Date.	Reporter.	Sex.	Age.	Treatment.	Result.	Reference.
1	1852	Gairdner, W. T. ....	Female	Adult	None	Death	Tr. Path. Soc., Lond., (1850-51) 1852, iii, 374.
2	1858	Simon, E. ....	Male	44	None	Death	Bull. Soc. Anat. d. Paris, 1858, xxxiii, 30.
3	1881	Jones, Talbot .....	Male	58	None	Death	Med. Rec., N. Y., 1881, xix, 600.
4	1882	Doran, Alban .....	Female	58	Removed	Recovery	Trans. Obst. Soc., Lond., 1882, xxiii, 164.
5	1887	Gooding, J. C. ....	Female	19	Removed	Recovery	Lancet, Lond., 1887, i, 311.
6	1890	Wells, Spencer. ....	Female	4	Removed	Recovery	Brit. M. J., 1890, i, 1362.
7	1893	Cazin, M. ....	Male	48	Removed	Recovery	Bull. Soc. Anat. d. Paris, 1893, lxviii, 312.
8	1896	Erldheim, S. ....	Female	22	Removed	Recovery	Wein. klin. Rundschau, 1896, x, 131.
9	1896	Marfan, A. B. ....	Female	2½	Removed	Recovery	Press Med., Paris, 1896, 133.
10	1896	Jessett, F. B. ....	Female	Adult	Removed	Recovery	Brit. Gynaec. Jour., 1896-7, xii, 156.
11	1897	Hearn, W. J. ....	Male	8	Removed	Recovery	ANNALS OF SURGERY, 1897, xxv, i, 703.
12	1898	Braithwaite, J. ....	Female	4	Removed	Recovery	Lancet, Lond., 1898, ii, 1472.
13	1901	Jacobi, A. ....	Female	7	Removed	Recovery	Trans. Ass. Am. Phys., 1901, xvi, 232.
14	1901	Marsh & Monsarratt. ....	Female	1 yr. 8 mo.	Removed	Recovery	Brit. M. J., Lond., 1901, i, 511.
15	1902	Catman, H. H. ....	Male	21	Removed	Death	Brit. M. J., Lond., 1902, i, 1267.
16	1903	Schramm, H. ....	Female	1	Removed	Recovery	Zentralb. f. Chir., 1903, xxx, 564.
17	1903	Boyd, S. ....	Male	11	Removed	Recovery	Clin. Jour., Lond., 1903, xxi, 306.
18	1905	Young, W. McG. ....	Female	9½	Removed	Recovery	Lancet, Lond., 1905, i, 157.
19	1907	Fort, R. E. ....	Female	2½	Removed	Recovery	ANNALS OF SURGERY, 1907, xlv, iii, 382.

to the umbilicus. Diagnosed as ovarian cyst with a long pedicle. At the end of two years she began to suffer with occasional vomiting after meals, and considerable shooting pains in and about the tumor, and tumor had enlarged very much. Operation disclosed a cyst densely adherent to parietal peritoneum, and embedded in the folds of the omentum; there was no pedicle. Some months previous to discovering the lump she had received a severe blow in the stomach. Recovery.

CASE 6.—SPENCER WELLS. Female, aged 4. Had large abdomen since early infancy that has increased in the last year. Diagnosed ovarian cyst. Operation showed a thin-walled cyst of omentum in the right iliac fossa, adherent to abdominal wall, cæcum and appendix. Recovery.

CASE 7.—CAZIN. Male, aged 48. First noticed the tumor the previous year which had developed without any history of trauma, and had gradually enlarged. Had been tapped several times, and  $7\frac{1}{2}$  liters of a bloody fluid withdrawn. Diagnosed as cyst of pancreas. Operation showed it to be a cyst of the great omentum, and adherent to large intestine. Recovery.

CASE 8.—ERDHEIM. Female, aged 22. Five years previously the tumor had appeared without cause, and had reached its present growth in fourteen days according to patient's account (this is questioned). No traumatic history obtainable, but has often done heavy lifting. Diagnosis: Ovarian cyst. Operation disclosed a bluish, transparent cyst wall adherent over a wide area, and covered with omentum. Cyst required opening and evacuating before it could be removed. There was no connection with any of the pelvic organs. Tumor reached from transverse colon to the bladder. Recovery.

CASE 9.—MARFAN. Female,  $2\frac{1}{2}$  years. Family history negative. Mother had noticed that abdomen had always been large, and at the age of 15 months it began to increase in size, and has been steadily enlarging for a year. No disturbance has been manifested in the physical condition until toward the last few weeks, when emaciation set in. Aspiration brought a blackish, hemorrhagic liquid—about two liters altogether. This had gradually reaccumulated. Operation revealed a cyst containing a large quantity of fluid. It was a multilocular cyst within the folds of the great omentum and had a pedicle. Recovery.

CASE 10.—JESSETT. Female; adult. Case was diagnosed as ovarian cyst. Operation showed a cyst within the folds of the omentum and adherent to upper part. It contained a quantity of cholesterolin. Recovery.

CASE 11.—HEARN. Male, aged 8. At birth his physicians noted that the abdomen was markedly distended. This disappeared at six weeks and was not particularly noticeable again until 6 years old, when the abdomen again began to distend. In the meantime he enjoyed good health. Of late, abdomen has increased rapidly in size, the chief difficulties being weight, dyspnea and frequent micturition. The abdomen was enormous, measuring 44 inches in circumference. An omental cyst was suspected, owing to lack of symptoms of other troubles. Operation discovered a cyst containing a dark greenish fluid and many other cysts. After evacuating a number the mass was drawn out and found to be attached to the

great omentum between the folds of which it had developed; it weighed about 50 pounds. Recovery.

CASE 12.—BRAITHWAITE. Female, aged 4. Measured  $22\frac{3}{4}$  inches at level of umbilicus; this had increased during two months. Tumor was found to be entirely within the folds of the great omentum and with the exception of adhesions to the intestine was easily removed. It contained  $3\frac{1}{2}$  pints of fluid. Recovery.

CASE 13.—JACOBI. Female, aged 7. Four years previous to seeing patient abdomen began to swell and the child lost flesh. A diagnosis of tubercular ascites was made and two quarts of a clear, slightly bloody serum was drawn off. After two years the swelling was again in evidence and was tapped a second time. Operation disclosed a very thin-walled cyst, multilocular, containing about two quarts of fluid. It was incorporated in and involved the greater part of the great omentum; it narrowed into two pedicles as it approached the stomach. Recovery.

CASE 14.—MARSH and MONSARRATT. Female, aged 1 year, 8 months. Abdomen was noticed to be enlarged about four months previously, but there was no complaint of pain. Abdomen measured  $23\frac{1}{2}$  inches just above navel. Was tapped four times. Operation showed a thin-walled, multilocular cyst springing from omentum of greater curvature of the stomach, and entirely enveloped in omentum. It contained about ten pints. Recovery.

CASE 15.—CATMAN. Male, age 21. Three months previously had received a severe blow in the abdomen from the shaft of a cart while riding a bicycle. Accident kept him from work for five weeks. Since then has complained of a lump in his stomach. Operation disclosed a tumor connecting with an opening into the stomach. Tumor was a blood-cyst between the layers of great omentum. Death.

CASE 16.—SCHRAMM. Female, aged 1 year. Enlargement of abdomen had been observed four months previously; was growing larger. Abdomen measured 91 cm. in circumference at umbilicus. Tumor mass could be easily outlined. Diagnosis: Tubercular peritonitis, with fluctuating exudate. Operation disclosed a cyst occupying entire omentum, more a conglomerate mass of cysts. It was removed entire. Recovery.

CASE 17.—BOYD. Male, aged 11. Family history negative. Always felt well until January of the present year (1903). His trouble began with vomiting, loss of appetite, and inability to run about because he felt so tired. His abdomen began to swell at this time and has increased steadily in size. Has had constant pain in lower abdomen, but never of a severe nature, and has lost much flesh. Diagnosed as tubercular peritonitis; also cyst of the left kidney. Operation disclosed a large thin-walled cyst covered by and occupying the cavity of the great omentum. Twelve pints of greenish-brown fluid removed. Was attached to the pancreas, but did not appear to spring from it. Recovery.

CASE 18.—YOUNG. Female, aged  $9\frac{1}{2}$ . Body had always been full from infancy, and was enormously distended from beneath the costal arch—which was bulged—to the symphysis. At operation a thin-walled cyst was found containing other cysts. It involved the anterior layers

of great omentum, and was adherent to the stomach; 32 pints of fluid were removed. Recovery.

CASE 19.—FORT. Female, aged  $2\frac{1}{2}$  years. Had had two attacks of acute indigestion, each lasting several days. Abdominal enlargement was noticed by the mother eighteen months previously. Child measured 28 inches at level of umbilicus. There were no symptoms other than dyspnea. Operation revealed a dark glistening tumor within the folds of the great omentum. Recovery.

THE FOLLOWING CASES HAVE BEEN REPORTED AS OMENTAL CYSTS, AND WHILE SUCH, DO NOT COME WITHIN THE MEANING IN THE SCOPE OF THIS PAPER.

1. GAY. (Ext. f. record of Bost. Soc. f. Med. Imp., 1859, iii, 248.) Female, age 46. Is not at all certain what he found, but in addition to opening the abdomen and evacuating a large amount of fluid, he drew up into the wound a number of tumors firmly connected with omentum, of a firm "scirrhus" hardness, and firmly fixed in the omentum. He feared to remove them. Recovery.

2. THORNTON. (Brit. M. J., 1882, ii, 1243.) Adult; female. A small multilocular cyst the size of a cherry was removed during ovariectomy. It was attached to the lower border of the great omentum by a small pedicle. He thinks it was an ovarian cyst owing its origin to cell infection.

3. THORNTON. (Brit. M. J., 1882, ii, 1243.) Female, 47 years old. Tumor the size of a cocoanut with a thick sac attached by thick pedicle to the omentum. It lay under the right border of the liver; it was a mixed sarcomatous cyst. Recovery.

4. ORMSBY. (Med. Press & Circular, Lond., 1883, xxxv, 258.) Female, aged 26. Had had large abdominal tumor for six years, and measured 54 inches at the umbilicus. Operation disclosed a multilocular tumor containing fluid so thick it would not run through the trocar. It sprung from the great omentum.

5. EDEBOHLS. (New York Jour., Gynæc. & Obst., 1893, iii, 614.) Female, aged 37. Had noticed symptoms of enlargement for eight months previously. Tumor had a distinct cyst wall which was gangrenous over a considerable area. It was a mono-cyst, and contained a chocolate-colored fluid. It had no connection with any structure, excepting the omentum to the lower border of which it was attached by a firm pedicle.

6. KEEN. (ANNALS OF SURGERY, 1898, xxvii, 220.) Male, age 48. About fifteen months before had noticed a lump a little larger than an egg in the lower right segment of the abdomen, which gradually increased in size, of late rather rapidly, and finally filling the abdomen and causing much respiratory trouble and frequency in urination. Had never caused any great pain. Had no gastric or intestinal symptoms, excepting from compression of the bowels. Had lost 30 pounds in weight. Trochar at operation brought about 3 pints of dark, bloody fluid. On the right side the tumor was free from adhesions, excepting to the omentum, but on the left side it was intricately adherent to the omentum and the stomach was spread out fan-shaped over its entire surface. It was a mixed-celled sarcomatous cyst. The danger of tapping such a cyst was well

illustrated, as had it been tapped in the upper part the stomach would have been perforated, being spread out over it.

7. ROSE. (King's College Hosp. Rep., (1896-7), 1898, iv, 101.) Adult; female. Had been operated upon for a multilocular ovarian cyst. About a fortnight after the operation she complained of pain in the right loin. Examination disclosed a tumor occupying the right lumbar region and extending up under the costal arch. Diagnosed as a renal tumor. At operation a multilocular cyst was found connected to the omentum by narrow adhesions. Recovery. Rose thinks it originated in the right ovary and became detached through twisting of the pedicle.

8. MAUCLAIRE and DESARNAUX. (Bull. d. Mem. Soc. de Anat., Paris, 1902, lxxvii, 683.) Female, aged 52. First began to complain five months previously and was treated for gastric troubles, complicated with the uterus. There was some emaciation, obstinate constipation, and a prominence in the subumbilical region the size of an adult's head. A provisional diagnosis was made of cancer of the head of the pancreas, also of a cystic tumor. Operation, with death six hours later. Autopsy showed a probable cancer of head of pancreas, with hemorrhage into the omentum from a pancreatic vessel.

9. SCHWARTZ. (Gaz. de Osp., 1902, xxiii, 764.) Female, age 43. Family history negative. Never remembers having been ill; has had several abortions and was forced to take to bed because of pains in left side. Present trouble dates back eight months, when there was sharp epigastric pain and vomiting, and she noticed abdomen beginning to enlarge. Her physician found a tumor in the epigastric region. This was aspirated twice, getting some fluid. Tumor extended from ensiform cartilage to near umbilicus. Diagnosis: Either echinococcus cyst of liver or independent of it, or might be a cyst of pancreas, or from stomach and transverse colon. Operation showed cyst completely adherent to lesser curvature of stomach. Cyst wall was stitched to abdominal wall and aspirated two days later and as much of cyst wall cut off as possible. Recovery.

10. LANCE and LECÉNE. (Bull. de Mem. Soc. de Anat., Paris, 1903, lxxviii, 400.) Female, aged 60. Had noticed presence of tumor for four years, which had gradually increased to large size, until abdomen was the size of the uterus at full term. Diagnosis: Multilocular ovarian cyst. Operation revealed seven cysts containing yellowish fluid and some blood. Mass was easily removed. It was free in abdomen and had only two slight adhesions. It contained ten liters of liquid, and had a distinct capsule. Recovery.

11. MATTHEWS. (Brit. M. J., Lond., 1905, 1642.) Male, aged 8. Following attack of measles nine months previously he complained of pain in left side. There was gradual distention of the abdomen. Greatest circumference measured 27 inches. There was no history of any previous illness or trauma. The tumor consisted of a large sac and contained 6 pints of dark-brown fluid. It was attached by a thick pedicle of omentum to transverse colon.

12. BIDWELL. (Brit. M. J., Lond., 1905, ii, 806.) Male, aged 62.

Had always been stout, but recently his abdomen had begun to enlarge and was enormously distended. It was tapped, and 4 gallons of blood-stained fluid withdrawn. Afterwards a hard mass could be felt, and was diagnosed altogether five times. Diagnosis: Malignant disease of the omentum. Operation disclosed a cystic tumor that sprung from the omentum by a distinct pedicle. It contained a growth which was not examined. Recovery.

Of the nineteen patients, nine were adults—47 per cent., while ten were below ten—52 per cent. (One of eleven years is included for convenience.) This is too nearly an even division to lend much weight to the theory of congenital origin. As a matter of fact seven cases only—36 per cent.; those of Wells, Hearn, Marfan, Marsh & Monsarratt, Young, Schramm and Fort are clearly congenital by their histories, while those cases occurring in adults (47 per cent.) were probably not congenital at all. It would seem, therefore, quite likely that while some cases are undoubtedly congenital, others may be acquired in later years through traumatism or other causes, just as we have hernia, hydrocele and many other affections both congenital and acquired. Certain it is that six, cases 2, 3, 5, 7, 8, 15, specifically state or intimate that they felt perfectly well up to the time of discovering the tumor, while three, cases 5, 8(?) and 21 are traceable to trauma—(my own making four).

One very striking thing shown is the great frequency of occurrence in females, 13 cases—79 per cent., as against six in males—31 per cent. This same preponderance being found also in the external variety of omental cysts: It has been suggested that some of these have originally been ovarian cysts that have become separated from their pedicles and attached to the omentum. This is not at all unlikely in cases occurring in females and in those of the external variety, but can certainly not be said of those found in males.

The operative results have been especially brilliant. Sixteen cases were operated upon with one death, a mortality of 6 per cent. the oldest case being 58 years, the youngest 1 year of age.

The histological characteristics and the contents of these cysts are of such a wide variety that it is hard to suggest a

distinct etiological factor. Lymph, chyle, serum and blood have all been reported; my own contained an enormous blood clot, and thirteen of the nineteen cases mention a distinct capsule or the record is so worded as to leave little room for doubt of its existence.

My own theory regarding the etiology of my case and all similar cases where a growth is involved, is, that there was first the endothelioma of the omentum; by inflammatory action the two surfaces of the omentum became fused together, forming a closed sac within which grew the endothelial cyst. The blood clot contents of course being derived from repeated hemorrhages from the parent tumor.

My case is as follows:

Ada D., colored, married, age 50. About one year ago she noticed a swelling in the lower abdomen which gradually increased in size until the abdomen became enormous, the distension extending up under the costal arches causing them to bulge, and interfering very materially with respiration. Constipation was also a marked feature. So far as she knew nothing had ever happened to her as a possible cause other than repeated blows in the abdomen, given by a small child butting its head into her while running at full speed as a pastime. At times the tumor pained some, but not to any great extent; and she had always enjoyed good health up to the appearance of the tumor. Her principal trouble was from the great weight, difficult breathing, frequent micturition and constipation from pressure. Examination showed the abdomen enormous in size and distended apparently almost to bursting. In the prone position the swelling began from behind the ensiform cartilage and costal arches; breathing impaired. Tumor fluctuating. Vaginal examination negative. Diagnosis: multilocular ovarian cyst.

*Operation.*—Incision through right rectus. Abdominal wall very thin, not over one-quarter inch, including all layers. Immediately on opening the peritoneum the tumor presented itself, dark bluish-black in color. A trocar plunged into it brought away about half a pint of grumous fluid. There was also a small quantity of ascitic fluid external to the tumor. The tumor was semi-solid and occupied the entire abdominal cavity except the deep pelvis. No connection whatever with uterus, ovaries or

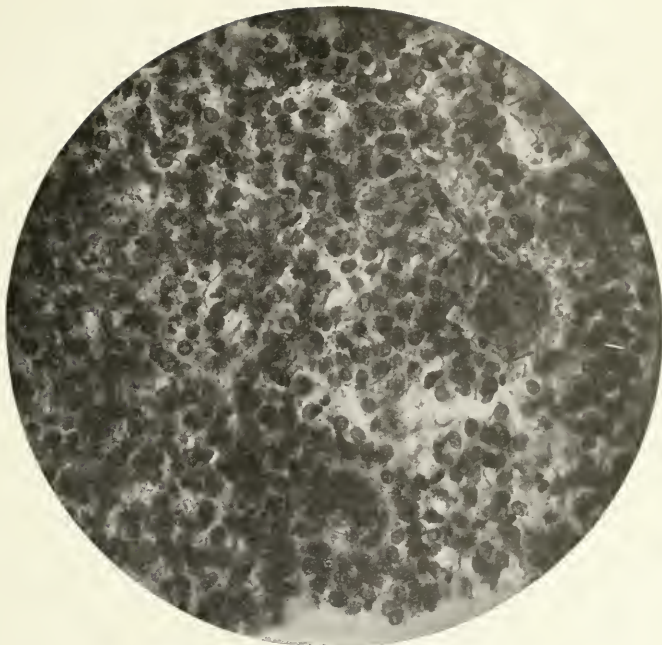
tubes, and the entire mass was completely enveloped within the cavity of the great omentum, and lay anterior to the intestines. Veins of the omentum enormously distended, many as large as a lead pencil, formed a network or mesh completely enveloping the tumor mass, and very little of the omentum itself remained,—only the network of veins,—most of it evidently having been absorbed by pressure. The transverse colon was pushed down almost to the symphysis pubis. There were very few adhesions, and these were mostly quite flimsy and easily broken down. There was one very firm fibrous band attached to the abdominal wall anteriorly, and another tough one almost like a pedicle, to the stomach, causing a suspicion that the tumor sprang from an old gastric ulcer, but there was nothing in the history to warrant such a finding, and later this was found to be only a dense adhesion. The wall of the stomach was slightly torn in the external coats in separating this adhesion and was whipped over with catgut. There were also some dense adhesions to the mesocolon and of course everywhere to the omentum. In fact very little of this structure was saved, being ligated in bunches and divided in order to turn out the tumor, which, owing to its large size and solid contents was impossible. Accordingly the sac which was very thick and tough was opened disclosing a number of smaller cysts inside, and enormous quantities of blood clot, many handfuls of which were removed before it was possible to pull the tumor through the incision. There was no pedicle.

After removal of the tumor the liver was found much atrophied from long-continued pressure, pale and anemic, and containing several small retention cysts which were punctured. Many bleeding points required ligation where omental adhesions had been ruptured, and a rent in the mesocolon was sutured. Salt solution was given under the breasts and about a quart sewed up in the abdominal cavity. Morphine-hyoscine-strychnine anesthesia was used supplemented with a few whiffs of chloroform.

The patient reacted well from the operation; there was no shock, and she made an uninterrupted recovery.

The specimen as removed weighed eight pounds,—which was simply the sac and parent tumor, it did not include any of the blood clot. Before opening, the tumor probably weighed not far from forty pounds. It sprang from the omentum between the stomach and transverse colon.

FIG. 1.



Section from author's specimen.  $\times 225$ .



PATHOLOGICAL REPORT, BY DR. JOHN S. HEATE.

With reference to the tumor of omentum case of Dr. Hasbrouck, microscopical examination shows it to be an endothelioma, or according to the more modern classification a mesothelioma.

The cells comprising the tumor are in general epithelial-like in structure, some having considerable protoplasm and in shape polygonal, round, cuboidal or fusiform, according to location and pressure. They also show a disposition to arrangement in columns encircling the blood vessels, from which they appear to have their origin. The fibrous stroma is very vascular, resembling some forms of angio-sarcomas which, taken with the intimate relation between the cells and stroma, places it with the connective tissue type of tumors, and this type of cells, their arrangement and the organ involved makes it most probably an endothelioma. (Fig. 1.)

My case appears to be unique in two particulars: 1. Its character, originating from an endothelioma of the omentum. 2. The contents, an enormous blood clot. (Case 2, Table I, might possibly come under this variety.)

*Symptomatology and Diagnosis.*—Very little is to be gained from the symptoms leading to the diagnosis of the disease. In some cases there is pain of more or less intensity, but usually not very severe. Gastric disturbance—nausea, vomiting and anorexia are often present, but not in all cases; weight and dyspnœa are complained of, and bladder symptoms and constipation from pressure. Emaciation occurs after much enlargement has taken place. In my own case there was nothing whatever to point to a diagnosis. From all of which it would appear that there are no specially characteristic symptoms,—the condition merely simulating the other forms of cystic growth of the abdomen.

It is not strange therefore that one fails to make an exact diagnosis, as the condition simulates such a wide variety of disorders. In fact, almost everything else has been diagnosed; lipoma, ascites, ovarian cyst, aortic aneurysm, hydatid cyst of the liver, cyst of urachus, cyst of mesentery, pancreatic cyst, and encysted and tubercular peritonitis have all been named. It is doubtful if the diagnosis can be accurately determined from the limited amount of data usually at hand and the extremely rare occurrence of cases, and the condition is

much more apt to be discovered at operation than determined beforehand.

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## THE INCONSISTENCIES OF THE GAUZE PACK.\*

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MORE and more each year, since I began the practice of surgery, there has grown in my mind a conviction that there are certain marked inconsistencies connected with the use of gauze, as ordinarily employed in our work. Let me say at the outset that I do not wish to be understood as condemning gauze packing in general. I am inclined, however, to doubt whether the introduction of gauze into surgical practice was as much of a blessing as it at one time appeared that it would be. Outside of its service as a dressing and sponge material, to which no legitimate objection can be offered, gauze is employed in surgery for: first, draining recent or granulating wounds, and packing sinuses, cavities, *et cetera*: and second, walling off septic matter while performing abdominal operations.

1. Methods of drainage were in general use before the principles of drainage were well understood. We drained before we knew why we drained. In the search for an ideal drain numerous materials have been employed. A strip of gauze was simply the means of applying to a wound the law of capillary attraction. Since it is a common experience that gauze frequently fails to drain, tubes of rubber or of other material have long been in use, while more recently combinations of rubber and gauze (split-tube and cigarette drains) are being substituted. The call for improvement in the manner of draining has come, because the object for which the gauze is employed is so seldom obtained. Instead of facilitating the removal of wound products, gauze, in fact, acts as a successful stopper to the outlet of the wound and impedes the natural outflow from it.

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The one thing to be desired in all drainage is the patency of the wound orifice, in order that the objectionable contents may escape. Whatever prevents this escape, either by clogging the cavity or by obstructing the opening, must be undesirable. Herein lies the chief indictment against the gauze drain, for both offences can be laid at its door. Not all the trouble, however, is due to the gauze; much of the mischief is done by the surgeon. As usually employed there could be no more efficient plug than the stereotyped gauze packing that is placed in a wound. Purulent discharges are not drained, but the gauze becomes soaked with them. The wound drains better when the packing is removed. In the instances in which the gauze pack is applied to arrest hemorrhage, the end to be attained is just the opposite of drainage and the gauze should be put in as tightly as possible. To express it tersely, when intended for a drain, gauze should be inserted after the manner of a lamp-wick; when used for hemorrhage, it should be packed in like wadding with a ram-rod.

The edges of a wound from which an unprotected tightly-fitting gauze tape is protruding begin to contract around it and become adherent to it in a few hours. Unless the secretion be of a very thin consistence no capillarity will be present and for this reason discharges which would easily be evacuated are held in by the very means employed for their removal. In shorter terms, a tight drain is worse than none.

To those who have seen the light and who are now using rubber tissue or tubes (and often no drainage at all where formerly they thought it indispensable), this arraignment of gauze may seem superfluous, but I am convinced that many surgeons do not yet appreciate the plain principles here involved. There is a field for the use of gauze in packing sinuses, fistulæ and granulating wounds, so that healing may take place slowly from the bottom. Even here, however, the packing should be loosely done and the gauze preferably saturated with some substance which will prevent sealing of the wound edges. But it is as a drain that the disadvantages of gauze constantly force themselves upon us. While some of us are probably not drain-

ing any more or less frequently, we are draining more judiciously and with clearer conceptions of why we drain. An eminent American surgeon said recently as he left a large wound open and packed it with gauze: "If I drain, this patient is sure to get well; if I close up, he may possibly die—therefore, I drain." Now, as far as my knowledge goes, I am not sure that I ever saved or lost a patient because I did or did not use a gauze drain. Apparently the matter is not always susceptible of proof on either side. Some will persist in the use of gauze drains and, in the event of disaster, console themselves by believing that it is better to have drained and lost than never to have drained at all. There are drains that do not drain and those who get good results with them are merely proving that no drainage was needed.

There is no controversy as to the object in view in the treatment of open wounds. If the surgeon be sure that the wound, unaided, will free itself satisfactorily from all deleterious fluids, he will insert no drain—and it is well. If, on the other hand, the surgeon be sure that the wound needs assistance, he will resort to artificial drainage—and it is well. Success follows both modes of treatment, and to some it may seem that it makes no difference whether we drain or do not drain; but surely to none can it seem a matter of indifference to employ or not to employ, for the purpose of drainage, a material like gauze tightly packed into a wound. It would appear, further, that all must recognize the importance of settling definitely the question whether a strip of gauze inserted loosely as a wick will continue to drain efficiently after it becomes saturated with pus or whether it will then cease to drain, thereby necessarily interfering with the natural discharge of fluids from the wound.

2. When we come to consider the use of gauze to wall off septic matter while operating within the abdomen, we approach a question which vitally concerns the work of every surgeon. I realize that I shall call attention to some matters not heretofore discussed and say some things which may be productive of much argument, and perhaps refutation of my opinions. My

criticisms of the method in vogue are derived entirely from observation of the work of others. For my part I have never fallen into the routine way of packing off with gauze in the abdominal cavity. There always seemed to me some well-founded objections to it and, as my mortality did not seem to be effected by omitting it, I continued to do without it. But, I believe that the majority of operators are in the habit of placing large pads or even huge rolls of gauze in the abdomen after making the incision in pus cases or suspected ones. This is done in order that there may be a protecting wall around the purulent area to ward off infection from the clean portions. To accomplish this end there must be a long incision, the viscera are subjected to unnecessary manipulation, and very likely the uninfected regions will be constantly in contact with pus-soaked gauze. Capillarity exerts its influence also, here as elsewhere, and, when one end of a gauze pad is in contact with purulent discharge, the whole piece will become soaked and the other end soiled, if sufficient time is allowed.

A glance at the accepted plan of introducing gauze for walling off will indicate its inconsistencies and even its dangers. At least, it may not be difficult to show its uselessness. When a free suppuration is present in the abdomen, the septic material will generally be seen at the incision, as soon as the cavity is opened, and, if an attempt is made to pack it off with gauze (though all the pus possible be first sponged away), the only sure thing done is the carrying of infectious products by means of the gauze to distant clean areas, there to remain during the operation as an added source of danger. In the case of an abscess already localized by nature, if the gauze might seem to be of use, it is when the shielding wall is, for some reason, intentionally broken through; but here it is open to the same objections as have just been mentioned. The truth is, exposure of peritoneum to gauze saturated with pus is just as pregnant with danger as the presence of pus itself among the intestines. Besides, the gauze pack, as a foreign body, interferes with the normal resisting power of the peritoneum. The superior tolerance of this membrane for infection and traumat-

ism explains why the mortality in abdominal surgery is not greater, particularly when the pack is used. Certainly every opportunity is afforded to extend infection by pushing rolls of gauze through collections of pus into healthy parts or by packing around abscesses with an artificial wall of gauze which becomes steeped in septic matter. And, finally, a glaring inconsistency is seen in the removal of the packs with already contaminated hands and in the unavoidable rolling upward of intestinal coils against the purulent area.

Perhaps some one will say that these observations may appear to be just, but that the conditions as described do not exist. That may be true of individual surgeons; but is it not probable that these things are being done over and over without a thought as to whether they are necessary or harmful? And is it not evident that many of those, who believe they are walling off, are not doing it? Some one again may ask: if these objections against the gauze pack are to be sustained, what method shall we employ? It is not the purpose of this paper to provide ways and means. It might be suggested, however, that the gentle art of sponging will take care of the visible pus and that what lurks behind had better stay where it is and be permitted to escape later than to be carried to parts we know not of.

## PREVESICAL ABSCESS.\*

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THE clinical interest of the space of Retzius exists in suppurative disease of that space. A condition first described by Wenzel Gruber in 1862, since then cases have from time to time been reported, appearing chiefly in the French and German literature.

In 1856 the Swedish anatomist Retzius presented to the Academy of Stockholm the first detailed description of this space, indicating at the same time the surgical importance of that region. As described by Retzius the space does not conform with the findings of more recent observers, and not until the publication of Leusser's studies in 1885 have the anatomical relations of this space been defined. Subsequent collaborators, chief among whom are Pinner, Panzat, Delbet and Waldeyer have in the main corroborated his findings.

The prevesical space is one peculiarly designed for its special function. Its contents are a mass of loosely reticulated connective tissue enclosing masses of soft fat, there are few blood vessels and some lymphatic glands. The boundaries of this space are in part fixed and in part flexible, which together with its soft contents, permits of the distensibility of the bladder. The surgical features of this region are dependent upon the arrangement of the fasciae contributing to its formation.

According to Waldeyer, the posterior rectus sheath terminates several inches above the symphysis, forming the semilunar fold of Douglas. Beneath this level the recti muscles on either side are covered posteriorly only by transversalis fascia.

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The fibres of the recti muscles descend and are inserted on the anterior surface of the symphysis pubis, and the transversalis fascia descends to its insertion on the posterior surface of the same bone. It becomes evident therefore that a space results three cornered in its sagittal section and whose base is equal to the antero-posterior thickness of the os pubis. This space contains loosely woven connective tissue and fat and lodges the deep epigastric artery. This is called by Waldeyer, the prefascial space.

Immediately behind this is a space of greater dimension and representing the true space of Retzius or Cavum Retzii, lying truly speaking retro-mural and prevesical.

Anteriorly is the symphysis pubis and transversalis fascia forming the posterior boundary of the prefascial space.

Posteriorly is a layer of fascia continuous with that covering the floor of the pelvis and stretching over the anterior and lateral walls of the bladder. Usually this space reaches up only to the fold of Douglas but occasionally to the umbilicus.

In its lower part the space is permanently prevesical, lying in front of the bladder even in its collapsed state and behind the symphysis. The lateral limits of this space are bounded on either side by a fold descending from the extremity of the fold of Douglas, these on either side descending as pillars to the symphysis pubis, form portions of the ligaments of Hesselbach. The lowest limits of this space are formed by the reflection of visceral and parietal fasciae upon the floor of the pelvis and immediately overlying the bladder neck, the prostate gland and sometimes part of the posterior urethra. It is of interest to note that both of these spaces are divided by a thin and imperfect median septum.

For the sake of completeness it becomes necessary to mention at this juncture, what has been described as a third space. This is called the preperitoneal space. It contains a thin layer of connective tissue, and lies for the most part on a plane above the bladder. Behind is the peritoneum and in front is a fibrous fasciculus, a continuation of vesical fascia.

Truly speaking this is not a space nor is it of any surgical moment.

The present anatomical conception therefore shows a marked deviation from the original one of Retzius, describing

FIG. 1.

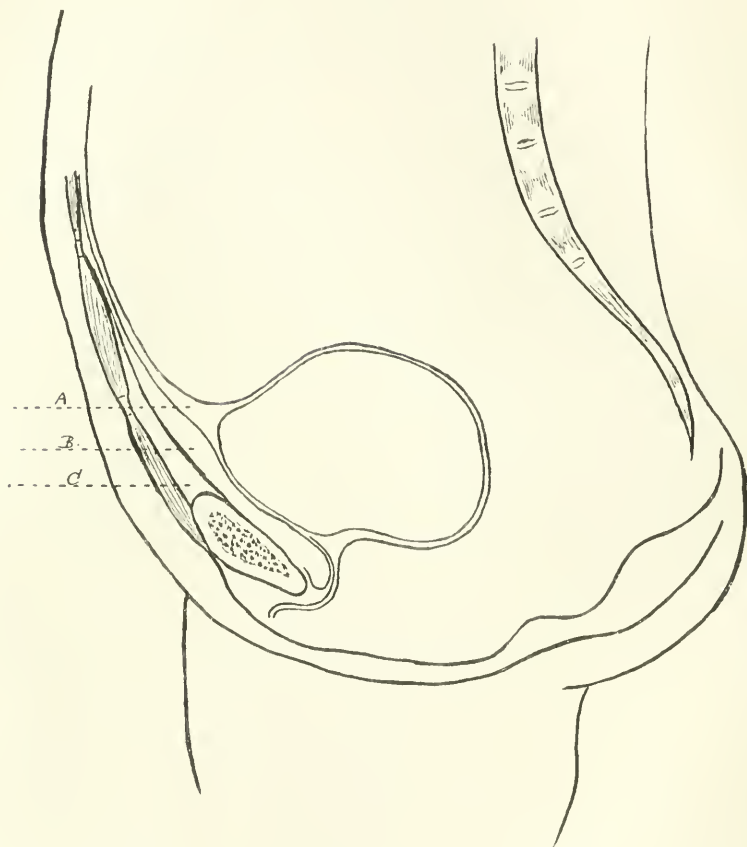


Diagram showing the three spaces constituting the space of Retzius. A, Preperitoneal; B, Prevesical; C, Prefascial.

three spaces instead of one, namely: 1. Prefascial or retro-muscular space. 2. Prevesical space. 3. Preperitoneal space.

This description is not merely academic but finds its practical application both in an intelligent interpretation of the etiology of infections of this region and in their treatment.

Besides fat the prevesical space contains a few lymph glands which have been called anterior vesical lymph glands. These glands were shown by Gerota to drain in part the mucous membrane of the bladder, Cunéo et Marcille having reached similar conclusions. Küttner by a series of injection experiments showed these anterior vesical glands to communicate with the mucous membrane of the posterior urethra.

Twice Bavy found the anterior vesical glands enlarged at operation, one operation having been performed for vesical calculus and cystitis, the other for malignant tumor of the bladder.

The obscure etiology of prevesical infection has led many observers to overlook the initial causes and to consider many of the cases to be idiopathic in origin. Bouilly considers this a large class as does also Martin, Duplay et Reclus, Le Dentu and Delbet. It seems probable however that prevesical suppuration is rarely if ever idiopathic. Steinthal believes the class to be small and Leibold, Michels, Hassler and Honsell deny the occurrence of idiopathic abscess in the Cavum Retzii. A strikingly contrary standpoint to that maintained by Englisch, who believed these abscesses to be a disease *sui generis* and due to a peculiar agent having a selective action upon the prevesical connective tissue.

Honsell agrees with Leibold, who maintains that primary abscess in the prevesical space, is in reality broken down hematoma resulting from traumatic causes. Going a step further he states that such hematomata occur in the prefascial space or as he prefers to call it the retro-muscular space, and therefore not truly in the prevesical space at all.

The question of etiology has been discussed by Bouilly, Guyon, Leusser, Englisch and others. Honsell in his very excellent article adopts the classification of Englisch, who divides these infections into four groups, namely: 1. Idiopathic. 2. Traumatic. 3. Metastatic. 4. Secondary. From the foregoing it becomes evident that the groups idiopathic and traumatic fall under the same caption. In fact it would

seem that for all purposes a division into two classes, primary and secondary is all sufficient.

The cases hitherto reported as metastatic all have been post-typhoidal. Honsell believes that inasmuch as typhoidal abscess shows a proclivity to the long muscles of the abdominal wall, such abscesses in great likelihood would occur in the prefascial and not in the prevesical space. If then we chose to be accurate in our terminology both the class names idiopathic and metastatic would fall away. A terminology however which would debar from this classification all abscesses occurring in the prefascial space would serve no good purpose and lead only to confusion.

In this connection must be mentioned Guyon's reported cases of "*Hygrome de la Bourse Sereuse Prévesical*," wherein serous fluid was found in the prevesical space. He suggests the existence of a bursa in this region and of its primary infection as a cause for prevesical abscess.

The large class of cases of infection of the prevesical space from traumatic causes distinguishes a class of its own, which demand recognition in this connection only in order to exclude them from the type of case under discussion. To this class belong all those cases resulting from infections of the prevesical space from external or internal injury, directly or indirectly applied.

Such cases are those resulting from gunshot or stab wounds with or without penetration of the bladder, or fracture of the pelvis. All those cases of traumatic rupture of the bladder or urethra with urinary infiltration, or injury to the bladder or urethra following instrumentation such as lithotripsy or catheterization or infection following supra-pubic section or puncture.

Eliminating therefore those of traumatic origin, a study of the reported cases of prevesical abscess reveals the fact that by far the great majority of cases bear a distinct relation to foregoing inflammation, and must therefor be considered as secondary.

The most prolific cause of suppuration in the prevesical

space is inflammatory conditions of the urethra, prostate and bladder. The primary inflammation may be acute but more often is of an indolent type and likely to be overlooked. Other causes are inflammation of the abdominal wall or sub-peritoneal tissues, suppuration in the pelvic or inguinal lymphatic glands, and osteomyelitis of the os pubis. In the female infection may emanate from diseased internal genital organs, and in children more especially from the intestines.

The following case I am permitted to report through the kindness of Dr. Herman Goldenberg, chief of the Genito-urinary Department of Mount Sinai Hospital. The case is of value because it deserves mention among the list of cases to be mentioned, and furthermore because certain clinical features have been studied which have been neglected in other cases, and which seem to throw much light upon the diagnosis which usually is obscure.

S. C., male aged 20 years, has had the usual diseases of childhood, has neither cardiac, pulmonary nor nephritic disease. He denies syphilis and gonorrhœa, and is habitually constipated. Present illness began suddenly eight days before admission to the hospital with pain referred chiefly to the rectum and a feeling of soreness in the pelvis which could not be defined. The pain became aggravated in the sitting posture. There was no frequency of urination but some burning and difficulty in starting that act. Two days after the onset of these symptoms the patient had to be catheterized for retention of urine, which after two more days again had to be performed. Since that time the patient has been passing urine at frequent intervals with burning pain, and has had some chilly sensations.

At the time of admission the patient presented normally developed genitals, no urethritis nor evidences of any previous attack. The urine was normal. Rectal examination revealed a prostate somewhat enlarged for a youth of his years, and on the right side was a small area distinctly more tender than the rest of the gland. Cystoscopic examination showed the trigone somewhat injected and "in the interval between the ureteral orifices were several small ulcers to which some mucus shreds were adherent."

The patient was treated by means of instillations of 2 per cent. nitrate of silver. He remained ten days in the hospital, during this time the temperature and pulse were normal, the burning sensation on micturition disappeared, and considering himself cured asked for his discharge.

Eleven days afterward the patient returned to the hospital with the statement that he remained entirely free from any disturbance for seven days, he then began to have pain in the hypogastrium difficult to localize accurately. At about this time a hard and rather globular mass appeared in the median line and just above the symphysis. During this time there had been little or no constitutional disturbance. Urination was normal, the urine containing neither blood nor pus. In the hypogastrium and just above the symphysis in the median aspect is a tumor resembling much in outline an enormously distended bladder. This tumor extends to about one and a half inches below the umbilicus and to about two inches to either side of the median line. It is hard, very slightly tender and flat upon percussion. The tumor does not vanish upon catheterization, and when examined bimanually the mass is recognized to be anterior to the bladder. The prostate gland is smaller than when the patient was first seen and is no longer tender. There is a moderate leucocytosis, a differential leucocyte count was not made. The temperature fluctuated daily from 99 to 101.4 and the pulse proportionately.

The cystoscopic examination revealed a most intense œdema bullosum of the entire anterior wall of the bladder with numerous submucous hemorrhages. The trigone was slightly injected, the rest of the bladder was normal.

The patient was treated with Kemps rectal irrigations and later poultices to the hypogastrium. In the course of the following few days, the character of the mass changed somewhat. Its outlines became more diffused and there seemed to be a sense of deep fluctuation. Five days after his second admission the patient was operated upon. A median incision was made over the tumor. Upon a plane just posterior to the recti and corresponding to the prefascial space was encountered a dense firm fibrous structure three quarters of an inch in thickness, giving much the impression of new growth. This extended laterally for some distance and represented inflammatory induration of the transversalis fascia. Only after extending the incision

through this thickened structure was the abscess cavity reached. The abscess was distinctly in the prevesical space and bore no direct communication to any other focus of infection. Bacterial examination showed the presence of staphylococcus aureus. The patient's recovery was uneventful.

I am led to believe that infection in this case emanated from an infectious nidus in the prostate excited by the catheterization and carried by the lymphatics to the anterior vesical lymph glands, which in their turn went on to suppuration and abscess formation.

In conjunction with the foregoing, a review of the cases from the literature is of interest. The cases divide themselves into the following etiological groups: 1. Infection from the urethra and prostate. 2. Direct infection by perforation of the anterior bladder wall. 3. Infection from adenitis in the vicinity. 4. Infection from the female genital organs. 5. Infection from osteomyelitis of the os pubis. 6. Infection from the intestinal tract. 7. Infection emanating directly from the vermiform appendix.

GROUP 1.—*Infection from the urethra and prostate*—as mentioned above this is probably the most prolific cause, and occurring as in the case cited.

CASE 1.—MEIGNANT reports two cases both probably of urethral origin. The second case exemplifies well a condition encountered in several of the cases, namely, "abscess en bisac," or hour glass abscess. The primary abscess occurring in the prevesical space perforates the transversalis fascia and infects the prefascial space. The surgeon encountering this condition is likely to drain only the abscess in the prefascial space, overlooking the more serious condition underlying.

CASE 2.—PARA ET TUFFIER, female, uterus and adnexa normal, point of origin of infection, urethritis and cystitis. The entire lower segment of the abdominal wall from the symphysis to the umbilicus presented a painful board-like intumescence. The condition found was abscess in the prevesical space with intense inflammatory involvement and thickening of fascial structures of the abdominal wall.

CASE 3.—COSTANEDA Y CAMPOS reports case similar to the above, which is, however, of special interest because it ruptured spontaneously.

CASE 4.—HASSLER—Bottini operation performed two years previously. Large hypogastric tumor developed in course of several weeks, which proved to be prevesical abscess. Staphylococcus aureus was found.

CASE 5.—HOTCHKISS—Old stricture of the urethra and vesical calculus. Transversalis fascia, board-like in character and half inch in thickness. Marked inflammatory reaction, with little or no abscess.

GROUP 2. *Cases following perforation of the anterior bladder wall.*—This group of cases is secondary to aggravated cystitis whether that be due to the irritation of calculus or to tuberculosis, and would include cases of direct penetration of infection without apparent perforation. We have seen from the experiments of Gerota the relation of the bladder mucosa to the anterior vesical lymphatics.

CASE 1.—DUPLAY—Old prostatic with ulcerative cystitis, developed painful tumor in hypogastrium. Autopsy showed perforated ulcer of bladder and infection of prevesical space.

CASE 2.—CRISTOL reports case similar to the preceding.

CASE 3.—LEIBOLD—Female, tubercular nephritis and cystitis. Perforating ulcer of anterior of the bladder.

CASE 4.—HEWETT—Female, 9 years, tubercular cystitis, perforating ulcer infecting prevesical space. Spontaneous rupture. Died.

CASE 5.—LAUVERS—Male, 19 years, spontaneous rupture of the anterior abdominal wall. Resulting urinary fistula, calculus removed. Recovery.

### GROUP 3. *Infection from adenitis in the vicinity.*

CASE 1.—HONSELL—Man, for years having suffered from various tubercular lesions. Suppurating inguinal glands burrowed behind symphysis and infected prevesical space. Hypogastric tumor developed slowly. Abscess cavity found to contain tubercular granulation tissue.

### GROUP 4. *Infection from the female genital organs.*

CASE 1.—MICHELS (third case of series).—Although not positively stated, the infection of the prevesical space probably emanates from a ruptured tubal pregnancy.

GROUP 5. *Infection following osteomyelitis of the os pubis.*—The location of an abscess resulting from osteomyelitis of the os pubis, is determined by the place where the exudate pierces the periosteum. If the periosteum is ruptured in the upper part of the bone, infection will occur in the prefascial or retro-muscular space. If perforation occur in front it will present under the skin, or if below, the planes of least resistance will cause abscess to appear in the scrotum or the labium majus, or in the peri-rectal tissues. If, however, perforation occur upon the posterior surface of the os pubis it

must inevitably lead to infection of the prevesical space. Perforation at this point is least frequent owing to the fact that here the periosteum is re-enforced by the transversalis fascia.

CASE 1.—GRUBER—At autopsy the prevesical space was found the seat of abscess. The prostate gland was normal, but at either side was a channel of communication between the prevesical and ischio-rectal abscesses. On the left side the os pubis for some distance was denuded of its periosteum and the bone was eroded. Whereas the prevesical infection may have emanated from a peri-rectal abscess, I rather believe the infection to have been primary in the os pubis.

CASE 2.—GRENSER—Female, pregnant. Trauma to os pubis followed by fever and later developed hypogastric tumor. Autopsy showed abscess in the prevesical space communicating with large area of caries of pubic bone.

CASE 3.—KIRCHNER—Case of sudden onset in young man 21 years. Symptoms of fever delirium and pain and later the development of a tumor in the hypogastrium. Incision opened an abscess in the prefascial space which led to the os pubis denuded of its periosteum. The symphysis was infected and an epiphysis lay free in the cavity. The sequestrum was removed and recovery ensued.

#### GROUP 6. *Infection emanating from the intestinal tract.*

CASE 1.—MARTIN—Infant, 16 months old. Etiology is obscure though probably of intestinal origin. Prevesical abscess drained and recovery followed.

CASE 2.—MICHELS (second case of series)—Carcinoma of the intestine ulcerating and infecting the prevesical space.

CASE 3.—GUYON—Case similar to the preceding.

#### GROUP 7. *Cases following direct infection from the vermiform appendix.*

These cases would not be out of place in Group 6, but perhaps they deserve a special grouping.

CASE 1.—BRUN—Boy, 9½ years. Was sick for 14 days with symptoms of acute appendicitis. Gradually there developed a painful tumor in the hypogastrium. The urine having been clear suddenly contained foul pus. Autopsy showed an abscess in the prevesical space. The posterior wall of the abscess cavity was formed by the anterior bladder wall and peritoneum. The appendix lost itself in adhesions in the posterior wall of the abscess cavity, its lumen communicating directly with same. A second perforation opened freely into the peritoneal cavity.

CASE 2.—TUFFIER cites a similar case which however recovered after draining the abscess cavity; a fecal fistula persisted, until an intra-

abdominal operation was undertaken. The appendix was found to be the cause. Recovery followed.

Leusser, Englisch, Bouilly, Guyon and Gerardin have attempted to delineate the clinical sequence of this disease, dividing the symptoms into stages. It is apparent that no such periods can occur in a condition dependable upon so many different causes. Nor does any one clinical picture portray its many manifestations.

Bouilly, Leusser and Englisch divide the symptoms into two groups: first, prodromal; second, tumor formation. Honsell correctly says, no periods exist, some cases begin with tumors and in others death may supervene before that event. Although most of the cases have occurred in adult life neither infancy nor childhood precludes that condition, one case having occurred at the age of 16 months, and another at 9 years. The condition is more frequent in the male but a fair proportion of the cases have occurred in the female.

In consequence of the fact that infection of the prevesical space is practically always, except in traumatic cases, secondarily invaded, there must precede a group of symptoms referable to that primary lesion. Without entering upon the symptoms of that primary group, whether that be symptoms of cystitis, osteomyelitis or appendicitis, there comes a moment when the prevesical space becomes invaded and from that time on there is a similarity of symptoms. Pain is a prominent symptom, it is not necessarily severe. It is difficult to locate in the milder cases and gives the sensation of pressure or weight in the pelvis. There is some tenderness which becomes marked only with the appearance of the tumor. The patient stoops forward in walking or standing in order to prevent contraction of the abdominal muscles. The tumor may appear early, but in most of the reported cases appeared late. The formation of a tumor in this region rather than a diffuse phlegmon is due to the distribution of dense fasciae preventing the dissemination of inflammatory materials, and as a result of that an enormous thickening of the fibrous

walls of this space. The tumor is usually in the median line, but may be somewhat to one or the other side.

In outline when seen early it is globular and appears above the brim of the pelvis, later its lines become more diffused and at a still later period may no longer be globular, but gives the impression of a board-like hardness to the lower part of the abdominal wall. Fluctuation if it occurs at all appears late and only after the abscess has perforated into the prefascial space, producing an abscess "en bisac" or hour glass abscess. There may be no urinary symptoms unless the bladder becomes secondarily involved. Constitutional symptoms are variable but are usually mild.

The bacteriology of prevesical abscess has not been satisfactorily investigated. In my case the organism was staphylococcus aureus, this organism was found also in one other case in which the bacteriology was studied. In Honsell's case tubercle was found.

The very significant cystoscopic finding in the case described above has led me to believe that this may be an accompaniment of all cases of prevesical suppuration, and therefore a valuable sign in the diagnosis of that condition. I refer not only to the œdema bulbosum but also to its limited distribution to the anterior bladder wall.

A remarkable issue of these prevesical inflammatory tumors is their spontaneous resolution. This has frequently been observed. Merkel reports one case in a series of 5, and Cotte, quoting Villiers, mentions this occurrence five times in a series collected by him of 53 cases. Resolution is accompanied by subsidence of fever pain and the gradual disappearance of the tumor. The usual termination, however, is by suppuration which if not relieved by incision ruptures spontaneously. A most unfortunate termination is by perforation into the peritoneal cavity, an event which has been observed 10 times. Spontaneous rupture externally usually occurs in the median line and occasionally by multiple perforation. Rupture into the bladder and rectum has also been observed.

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## SYMPTOMLESS HEMATURIA.\*

REPORT OF THREE CASES IN WHICH HEMORRHAGE CEASED AFTER CATHETERIZATION OF THE URETERS.

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IN reporting these cases I do not pretend to claim that ureteral catheterization has cured them, and only state the facts in each case. It is rather interesting to note that immediately following ureteral catheterization blood disappeared in these 3 cases, and up to the present time has not returned.

CASE I.—Male, 45, carpenter. He was first seen by me in November, 1905. His previous history was negative, no history of any trauma. Six months before I saw him he noticed blood in the urine that has continued unintermittingly. No frequency, pains or symptoms of any urinary irritation. There was a slight loss of weight but he did not appear anaemic. The urine passed was very bloody. Sp. Gr. 1020, acid reaction and a trace of albumin—the microscopical examination was negative except for blood and a few leucocytes.

Cystoscopic examination November 10, 1905. Bladder capacity, 300 c.c. Mucous membrane of bladder normal, blood seen flowing from the right ureter. Both ureters were catheterized, ureteral catheters passing to the kidney pelvis without obstruction. The urine collected from the right ureter showed blood and a few leucocytes, otherwise normal, that from the left ureter was perfectly normal. There were no more white cells present than could be accounted for by the amount of blood seen. Examination of urine 24 hours after ureteral catheterization showed clear urine apparently free from blood, but on microscopical examination a few red cells were noted. Forty-eight

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\* Read before the American Urological Association, Atlantic City, June 5, 1907.

hours after ureteral catheterization the urine was clear and no blood cells could be found on microscopical examination. The blood has never recurred in the urine up to the present time, 20 months after ureteral catheterization.

CASE II.—This case was referred to me by Dr. Mason. Male, 53. Past history negative. One and a half months before I saw the patient his wife noticed that he was passing bloody urine, three days before this symptom was noted the patient was working on a roof supported by a rope tied around his waist. At the time I saw him he had never had any symptoms other than the blood in the urine. When examined I found him to be a well preserved man, slightly anaemic. On passing his urine it was noted that it contained a large amount of blood. The blood had continued without cessation for a month and a half. Cystoscopic examination revealed a normal bladder mucosa and showed bloody urine escaping from the right ureter. Catheterization of the two ureters showed bloody urine from the right side that contained no abnormal elements except the red blood cells; while that from the left side was perfectly normal. An examination of the mixed urines was negative except for the blood. The day following the ureteral catheterization the urine was perfectly free from blood. It is now three and one half years afterwards. There has never been any recurrence of blood in the urine and in all this time the patient has been in good health.

CASE III.—R.M., 56 years of age, bank cashier from Virginia. This patient was first seen by me in October, 1906. Previous history, pneumonia at 21, sick two months, recovered; no venereal diseases. During the same year that he had pneumonia his urine became bloody. At times the blood would almost disappear, but exposure, indigestion or exercise would cause a recurrence. There was no pain when bleeding would occur except when clots would be present in the urine. This was 35 years before he was seen by me. As a young man he consulted a number of prominent surgeons among the number being Dr. Nathan R. Smith of Baltimore, Dr. Hunter McGuire and others. He was advised against any operative procedure.

During the last 15 or 20 years the blood has been much greater in amount and much more constantly greater than during the early years of his illness. He has never had any pain in

the bladder or symptoms of vesical irritation. He has never complained of any symptoms other than that of blood in the urine for 35 years except he has had what he describes as attacks of lumbago. From what he says there is possibly some relation between the passage of clots and these attacks of lumbago which he describes. He says that the blood is always seen to be intimately mixed with the urine, but at times is more abundant in the last urine passed. The patient is an educated man and one I believe whose statements can be relied upon. He assured me that his urine had never been free from blood for 35 years and his present physician said it had been so to his personal knowledge for 17 years. At times the urine would be vermilion color, at other times it would vary between a port wine and almost inky blackness.

On examination it was seen that the patient was anaemic, emaciated and had the appearance of being a very ill man. On palpation of the kidneys no tumor could be felt and deep pressure elicited no more pain on one side than on the other. The other genito-urinary organs appeared normal. The urine passed by the patient was very bloody being the color of port wine and the last urine passed contained some small clots. Examination both chemically and microscopically of the urine was absolutely negative except for blood.

Cystoscopic examination on October 25, 1906, showed a normal bladder and very bloody urine escaping from the right ureter, both ureters were catheterized both catheters appearing to pass to the pelvis of the kidney without obstruction. Clear normal urine escaped from the left side while very bloody port wine colored urine escaped from the right side. Microscopical examination of the left urine was perfectly normal that from the right showed very numerous red cells and a few leucocytes. When I visited the patient at the Garfield Hospital 24 hours after ureteral catheterization he informed me that the bleeding had stopped. On examination the urine seemed to be clear and microscopical examination showed only a few red blood cells. I insisted on his having an X-ray picture taken, but he wished to go home first. As the bleeding has not recurred he has neglected to return to Washington. I have been in constant communica-

tion with him for the past twelve months. He has informed me that his health is better than it has been in years, he has gained weight, strength, and has no recurrence of the hemorrhage whatsoever.

NOTE.—Since this article went to press I have examined the patient referred to as Case 3. He has gained 26 pounds and appears in perfect health. He has had frequent microscopical examinations of his urine and at no time has any blood been noted. It is now 17 months since his ureters were catheterized.

## CYSTIC DEGENERATION OF THE KIDNEY.

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OF ST. LOUIS, MO.

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CASE.—Mrs. H. M. J., age 46, married, referred to me by Dr. W. C. Lewis, was admitted to the Rebekah Hospital August 13, 1906. During the five years previous she had complained of difficulty in breathing which at times was very severe, the attack would last from one half to four hours. Whiskey and other home remedies were made use of and on some occasions artificial respiration was resorted to. She occasionally complained of nausea, but never vomited. Five months ago she noticed an enlargement in the left lumbar region which rapidly increased in size.

*Examination.*—Urine from left kidney highly colored, specific gravity 1028, sediment, normal, blood, slight in amount, casts, both hyaline and granular. Urine from right kidney normal. A mass extending from the symphysis pubis upward to the left, behind the lower ribs, could be made out; approximately six or seven inches in diameter and twenty-one inches in length. There was some tenderness.

*Operation.*—A median incision showed the opposite kidney was not enlarged. A right lumbar incision exposed a multilocular cystic kidney; the visible cysts varying in size from a split pea to an orange. The size of the mass precluded the possibility of delivery through the incision in the loin until after thirty or forty cysts had been punctured. The vessels and ureter were separately ligated, the remaining mass removed and the cavity packed with sterile gauze. Convalescence was uneventful, the patient leaving the hospital six weeks later; after eighteen months she remains entirely well.

Under the name Cystic Degeneration, has been described a peculiar lesion manifested by the presence of multilocular cysts, occupying the area of and replacing the kidney. Frequently cystic kidneys contain no discernable renal tissue; in

other instances only part of the kidney is involved. The disease often exists for years; no diagnosis being made owing to entire absence of symptoms, while not infrequently sudden death takes place from uremia or cerebral hemorrhage due to kidney insufficiency.

Cystic kidney in the new-born has long been recognized. Fussell collected eleven cases in which it was necessary to mutilate the fetus in order to accomplish delivery. The tumors in the adult may be of enormous bulk weighing (as in Hare's case) as much as twenty-four pounds. These tumors are usually bilateral and may increase in size under observation.

Hematuria, sclerosis of arteries, hypertrophy of heart with accentuated second sound, and albuminous urine are among the more common symptoms. Cystic kidney occasionally, as in the case here reported occupies a large portion of the abdominal cavity. It is made up of numerous cysts varying in size from a pin head to a cocoanut and little or no recognizable renal tissue may be found. The fluid within the cysts is clear, slightly albuminous, presenting cholesterin, blood pigment and detritus resulting from degenerative and necrotic processes in the epithelium of the cystic wall. In some instances the connective tissue of the cyst is not covered by a recognizable amount of epithelium, in other instances epithelium, when found, varies in amount, both granular and necrotic; and in still other specimens columnar epithelial cells from the inner layer of the cyst wall are found. The matrix between the epithelial cell may be fibrous or myxomatous and is not infrequently extremely vascular.

Our lack of knowledge of the etiology of these cysts has given rise to much discussion. The earliest theory, that of Virchow, was that they were due to an obstruction of the tubules. Later he expressed a belief that cystic kidney was due to an intra-uterine papillitis, this view was reaffirmed by him in 1892.

Arnold, regarded the process as beginning in the pelvis of the kidney and speaks of the lesion as an "ascending pyelopapillitis fibrosa." The inflammatory origin of cystic

kidney, founded on the great increase of connective tissue in the pyramids and the numerous foci of round-celled proliferation present has been supported by Thorne.

Brigidi and Severi, in 1880, basing their opinion upon epithelial sprouts into the surrounding connective tissue from the walls of the tubules, especially of the straight tubules, also an increase in the layers of the tubules and proliferations of epithelium in continuity, so that the epithelium appears contorted within the lumen, claimed that cystic kidney bore marks of a tumor and called it multilocular adenocystoma, this point of view though confirmed by Chotinsky, Nauwerck, Hufschmidt, Janowski, Kalilden, Hain and Alber was declared by Marchand to be untenable. Durlach believes it due to a proliferation between the lobules of the kidney, that is, of tubules between the pyramids and their outlying cortex. Leichtenstein thinks it begins as an inflammation or inflammatory irritation in the arteriolæ rectæ, which are small vessels between straight tubules and give striations to pyramids.

Shaddock concludes that the condition depends on the mal-development of mesonephron or the Wolffian body fused with the metanephron and that the cysts result from the evolutionary changes in the included mesonephron. Van Mutach recognized from a microscopic point of view striking embryonal characteristics of cystic kidney.

Hildebrant explained the condition on purely embryological grounds. Deetmar, Schenkl and Rukert accept cystic kidney simply as a form of mal-development of the organ.

Milward divides the clinical history of the disease into three stages:

1. The stage of progressive enlargement of one or both kidneys without subjective symptoms. The renal enlargement is discovered, if at all, by accident. This stage may last from a few months to several years.

2. The stage of subjective symptoms and objective signs. This stage lasts from a few months to seven or eight years, or even longer. The signs and symptoms are dependent on the size and weight of the tumors.

3. The stage of decreasing elimination of urine. In this stage appear the symptoms of uremia, or cerebral complications. This disease which affects males and females in about equal proportion usually terminates fatally about the age of forty-five. The symptoms of the second stage are dull, aching pain in the region of the kidney. Flatulence, headache, dyspepsia, vomiting, anorexia and constipation are frequently met with. Examination of the urine may throw very little light on the diagnosis, though the specific gravity is usually low and the amount passed is generally slightly increased. A trace of albumen is usually found, but is never present in large quantity in the second stage except when there is a large amount of blood. Leucocytes may be met with in large numbers and pus is often present. Blood is usually present and may occur at intervals of weeks, months or years or may never be noticeable by macroscopical examination of the urine, though according to Milward it is always present and is significant. The symptoms of the third stage are those of uremia.

The treatment for congenital cystic kidney consists of removal of the organ, unless the other kidney is diseased which can only be positively determined by exploratory incision. While Schmidt, Neimeyer, Bardeleben, Hayems and others have performed nephrectomy for polycystic kidneys, the patients having died of uremia, the opposite kidney has in all cases been found to be the seat of rather extensive disease. Where the opposite kidney is involved an incision through the loin, puncturing the cysts and stitching the kidney to the lumbar muscles is the procedure indicated.

*Pathological Examination of the Specimen Removed in the Case Reported.*—GROSS. The kidney after evacuation of the larger cysts weighed 1,400 gms. It is 24 cm. in length and 15 cm. in width, and the shape is almost rectangular. The anterior surface is studded with small cysts varying in size from almost microscopical points to the size of a walnut. (Fig. 1.) They bulge outward prominently, giving the kidney the appearance of a bunch of grapes. The superficial cysts have very thin walls and are transparent. They are light yellow to brownish-yellow in color. The posterior surface is similar to the anterior; however, the cysts are not so prominent. The pelvis of the kidney is narrow and extends deep between

the upper and lower overhanging projections of cyst masses. The vessels entering are large, but not thickened. The ureter is not dilated.

In making the incision for the cut surface, the organ is laid open in its longest diameter, the incision being made from the convex surface toward what constitutes the pelvis. This cut passes thirty-three cysts, each larger than a pea. (Fig. 2.) The cut surface of the kidney shows little kidney tissue recognizable as such. No striations can be seen. The surface has a honeycombed appearance. The color of the kidney substance is grayish. The largest cyst is at the upper, inner pole, and has a diameter of  $7\frac{1}{2}$  cm. It is deep, round, and lined with a smooth surface, and crossed by falciform trabeculae in part. It has five depressions, about  $1\frac{1}{2}$  cm. in diameter, which have the appearance as if five small cysts had coalesced and formed the large one. Shining through the wall of the lower inner depression are seen two black cysts. The contents of the cysts are in part clear serous fluid; others contain a jelly-like colloid material. Some contain a purulent material, and others a black hemorrhagic fluid, or are clouded with a brown substance. Numerous smaller cysts are seen on the cut surface of the kidney. They are mostly round and form hollow spaces. Their septa and walls show traces of kidney parenchyma. The cyst contents is alkaline in reaction and contains albumin. Microscopically it shows red blood cells and leucocytes with granular degeneration. Fat is shown to be present by Sudan III stain. The calyces are only rudimentary and are distorted by compression of the cysts. Their lining is smooth and pink in color. The walls are thicker than normal. There is considerable pelvic fat.

**MICROSCOPIC: Section 1.**—Showing one of the smallest cysts. The cyst content is not stained. The cyst is lined by tubular epithelium which is slightly flattened. The protoplasm of the cells is granular and not stained as deeply as normal. The nuclei show a vesicular condition. They are nearly all large and contain less chromatin than do the nuclei of normal tubular epithelium. The connective tissue surrounding the cyst is increased, and is rich in nuclei. The tubuli contorti are increased in number and apparently widened. Their lining epithelium is wider than that lining the cyst and takes a deeper stain. (Figs. 3 and 4.) The glomeruli do not differ from those of a normal kidney. They are normal in number and size. Their capsule is not thickened.

**Section 2.**—Showing wall of a microscopic cyst smaller than a pea. (Fig. 5.) The content is not stained. The lining epithelium is much flattened and faintly stained. In places it is detached or absent. The connective tissue shows greater increase in nuclei than in previous section and replaces tubules to some extent. The picture is similar to that of a chronic interstitial nephritis. There is marked infiltration of lymphocytes. The tubules are elongated and flattened so that their lumina are filled. The glomeruli are distorted and deformed by pressure and the capsule of Bowman is thickened. Some glomerular tufts show vacuolization. It is probably a hydropic degeneration, however; no fat is seen by staining with Scharlach. The blood vessels are thickened; chiefly the tunica

muscularis. The lumina are large and filled with blood in the region near cysts.

*Section 3.*—Showing wall of a hemorrhagic cyst the size of a pea. (Fig. 6.) The content consists of blood pigment, degenerated epithelial cells and detritus. The epithelial lining of the cyst is absent, so that only a connective tissue lining is seen, which is wide and shows irregular heaps of new-formed nuclei. There are no tubules present. Some glomeruli are present, but show a more advanced stage of degeneration than in the previously described sections. They are small with greatly thickened capsules. The tufts fill the capsule only in part. The blood vessels are greatly dilated.

#### CONCLUSIONS.

I. In the cells lining the cysts, the entire row are alike, and apparently in the same stage of secretion, that is, the nuclei are poor in chromatin and show a vesicular condition. In the normal convoluted tubules, this condition is present in a few cells only while very many are rich in chromatin and show filaments or striations known as "ergastoplasm." This condition of the normal convoluted tubules is met with in active secreting cells. While the condition of the cells lining the cyst would correspond to a stage in secreting activity, it is not probable, however, that the entire row lining the cyst would show the same stage in secretion because we have no proof that secretion occurs in cells simultaneously. Therefore in my opinion the cells lining the cysts are less active in secreting power than normal epithelium.

II. These various theories of the origin of cystic kidneys have been discussed previously in this article. From the study of the microscopical sections I find that the smallest cysts are lined with the same epithelium as that lining in the convoluted tubules. Therefore, one must conclude that the cysts originate in the convoluted tubules by dilatation and proliferation, lining epithelium. In this kidney I can say with certainty that the cysts do not arise in the glomeruli, the blood vessels or the connective tissue.

FIG. 1



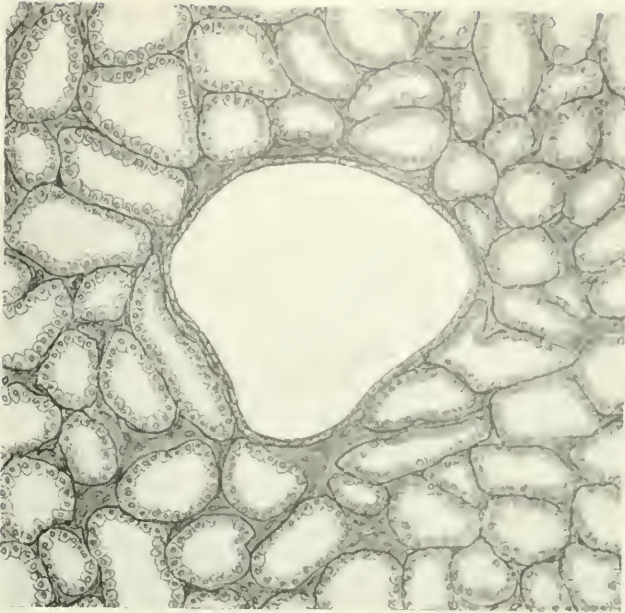
External surface of cystic kidney extending from the brim of the true pelvis to the angle of the scapula. Removed at operation from patient of Dr. E. K. Lewis. Recovery.

FIG. 2.



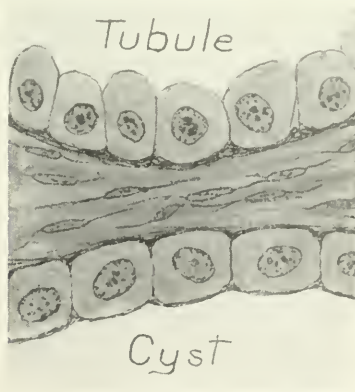
Transverse section of Fig. 1.

FIG. 3.



Microscopical appearance obj. 3. of one of the smallest cysts from section 1.

FIG. 4



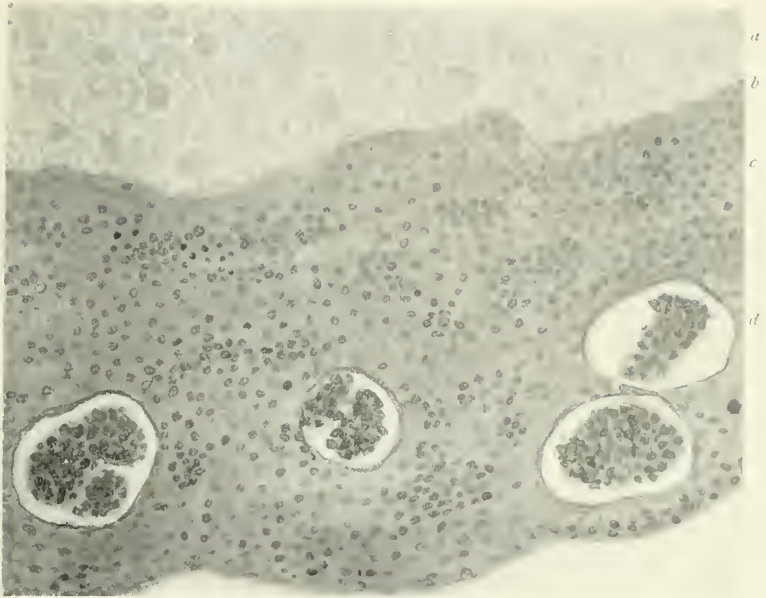
High power obj.  $\frac{1}{3}$  showing lining of cyst and tubule, from section 1.

FIG. 5.



Microscopical appearance of wall of a cyst smaller than a pea, from section 2. *a*, cyst lining *b*, flattened tubules.

FIG. 6



Microscopical appearance of wall of a hemorrhagic cyst the size of a pea, from section 3. *a*, blood pigment. *b*, connective tissue lining. *c*, round cell infiltration. *d*, degenerated glomeruli. No convoluted tubules are seen.



## VENOUS THROMBOSIS AND HYDROCELE OF THE INGUINAL CANAL.\*

BY JOSEPH RANSOHOFF, M.D., F.R.C.S. (ENG.),

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CONSIDERING varicosities of the pampiniform plexus, the rarity of thrombosis in them is striking. In varicosities of the lower extremity and of the rectum clotting and inflammation are of frequent occurrence. In the rare instances in which I have seen a varicocele thus affected, the process has, for the most part, been limited to the distal radicals and always in close relationship to the testicles and the tunica vaginalis. In contra-distinction to these cases I beg to call attention to thrombosis of the spermatic vein occurring higher up and in the inguinal canal, and leaving intact the lower vein radicals.

The long course of the spermatic vein and the comparatively slight amount of blood, which in an auxiliary way flows from the testicle through the deferential vein, would seem to make it a favorable place for stagnation in the blood column and thrombosis. It would seem that by violent effort, by direct injuries or by pressure of a truss, thrombosis with its usual sequences would be of common observation. Either this is not the case, or the condition, if observed, may have seemed so trivial as not to have been deemed worthy of record. At least in my study of relevant literature I have found nothing bearing on the subject. Nevertheless in the last few years I have seen three distinct cases of thrombosis in the spermatic cord within the canal, each affecting an adult without varicocele. I beg to submit a brief history of the cases.

CASE I.—J. W. F., aged 43, married, and of excellent habits. Has no history of venereal disease or of hernia. After violent

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\* Read before the Southern Surgical and Gynecological Association, December, 1907.

exercise at tennis he suddenly experienced very sharp pain in the groin attended with nausea and slight vomiting. When seen twenty-four hours after the onset there was some acceleration of the pulse rate and the temperature had risen to 102. After the third day the temperature had entirely subsided and continued normal. The first examination showed a very marked tenderness in the upper part of the scrotum, and the presence of a firm cylindrical swelling, evidently of the cord, extended into the inguinal canal; but failing by more than an inch to reach the epididymis. At the lower end a bifurcation of the induration could easily be felt. As far as it could be palpated the cord presented the feel of a thrombosed vein. Forty-eight hours after the onset, there developed a tenderness and a slight swelling of the epididymis, although the enlargement of the cord did not extend downwards. There was no enlargement of the external ring, nor could any impulse on coughing be elicited. Under purely expectant treatment and rest in bed, the condition gradually subsided, and in about ten days the restitution to the normal was complete.

CASE II.—S. G., aged 52, married. Has had several attacks of gonorrhea, the last one twenty-eight years ago. Has never had a hernia. He ascribes his condition to excessive golfing, but is not aware of having injured himself by any single violent effort. He presented himself at the office because of a dull pain in the groin, which had continued without abatement for one week. The pain was not severe enough to keep him from his work. There were no constitutional symptoms at any time. Through the thin abdominal wall the intra-canalous portion of the cord could be readily palpated. It was very tender to the touch, distinctly indurated and nearly as large as the little finger. Traced downward the induration could be felt in the upper part of the scrotum and was gradually lost in the lower part of the cord. Neither the testicle nor the epididymis was involved at any time. As in the previous case, the condition disappeared slowly in a little over three weeks.

CASE III.—S. R., aged 49, widower. Has no history of venereal disease. He has had a reducible right inguinal hernia for many years, for which he has recently had a new truss fitted. To this he ascribes his present illness, which began with pain in the region of the hernia sufficiently severe to confine him to his bed. When first seen he had slight elevation of temperature

and some malaise consequent thereon. There was some little nausea, but no vomiting. The bowels moved readily on slight stimulation. An examination showed the abdominal wall over the canal very much relaxed as one sees it after the long wearing of a truss. The hernial opening was large enough to readily admit the finger. It was empty but very tender. On my second examination, twenty-four hours later, there could be felt within it a tender cord running into the scrotum and not quite reaching the epididymis. During the next few days the latter became somewhat tender and sore. There was at no time any effusion into the tunica vaginalis. Three weeks in bed with rest sufficed to cause the induration in the cord to gradually disappear. Although more than a year has passed since the attack and the patient has continued wearing the truss, there has been no recurrence.

In each of these cases I have recently examined the spermatic cord and found it normal. While we are led to believe, and in the majority of cases it doubtless is true, that thrombosis of a vein recovers with the formation of a fibrous cord which remains, in these cases it is probable that by a process of liquefaction and absorption of the thrombus an entire restitution even to the calibre of the veins took place. In none of the cases was there any justification for operation, wherefore the clinical diagnosis of thrombosis of the spermatic vein might be questioned. In each of them an infective process could be positively excluded, and except in the third case a hernia did not exist. The slight participation of the testicle and the epididymis in the process and its secondary nature preclude even the suspicion of an ordinary epididymitis. All of the cases were on the right side.

With the exclusion of the most common etiological cause of thrombosis, namely, bacterial invasion, we must look to some mechanical obstruction or trauma from very violent muscular action as to the cause of the thrombosis in these cases. Whereas it is well known that even prolonged compression of a vessel as of the carotid artery in prevention of hemorrhage in major operations about the head is not followed by thrombosis,

this condition is much more likely to arise in thin walled veins with their many small and irregular tributaries. It appears to me that the cases described are a mild type of the condition following torsion of the cord, to which attention has quite recently been directed. In torsion of the cord, however, the symptoms are exceedingly severe and associated with symptoms of abdominal shock. In 70 per cent. of the cases collected by Bochdaneck castration became imperative by reason of gangrene of the testicle. In the great majority of cases the diagnosis of torsion of the cord was not made, and the operations were for the most part performed under the belief that there existed a strangulated hernia.

Fortunately I have had two opportunities of verifying the diagnosis of thrombosis of the spermatic vein by operation.

CASE IV.—J. C., aged 38, admitted to the Cincinnati Hospital, January 21, 1899. Has had a previous history of malaria. On January 9th while working on a flat car unloading timber, a jack-block struck him in the groin. He was knocked off the car, but did not lose consciousness at any time. With assistance he was enabled to walk to his home. Twenty-four hours after the injury was sustained, he noticed a swelling in the left groin and severe paroxysmal pains. The bowels moved regularly and there was no nausea nor vomiting at any time. He remained in bed for about two weeks, during which he states the swelling diminished and the pain in the groin abated somewhat.

Examination negative except for local condition. Over the abdomen there is a bluish-green discoloration of the skin near the anterior superior spinous process. This is evidently the result of a superficial ecchymosis. The left testicle hangs much lower than the right. In the cord for about two inches distinct irregular thickenings of the vein can be felt. The ring distinctly patulous admits the finger which comes in contact with a hard circumscribed swelling an inch or more long. It is of a diameter of the little finger and appears to have a distinct impulse on coughing. The cord feels like a thrombosed vein.

Operation January 23, 1899. General anesthesia. Incision over the external abdominal ring extending into the scrotum. Easy exposure of the thrombosed vein. The further steps of

the operation consisted of splitting the aponeurosis of the external abdominal oblique and thorough exposure of the contents of the inguinal canal. In this there was found an unoccupied narrow vaginal prolongation of the peritoneum and underneath it the cord with the vas deferens hidden from view by the thrombosed vein which extended quite into the internal ring. The thrombosed part of the vein, irregular in diameter and about two inches long, was resected. The operation was completed as an ordinary Bassini. The patient made an uninterrupted recovery and was discharged February 16, 1899.

This case was the nearest approach I have seen to a hernia resulting from a direct injury. The presence of a partly open peritoneal process directs attention to the possibility of an effusion into it as a result of the thrombosis, if the later had not been relieved by operation. When this process does not exist, a hydrocele within the canal can probably not develop. But in the presence of such a process, a thrombosis might, as in the following cases, be followed by a hydrocele of the cord, which, because of its rapid growth, might, and doubtless does, overshadow its cause, namely, a thrombosed vein.

CASE V.—Father M. K., aged 59, parochial priest. Was first seen November 24, 1906. For eight years he has had a right reducible inguinal hernia for which he has worn a truss. Ten days ago there appeared in the right inguinal canal a hard tender mass which has prevented him from wearing the truss. Notwithstanding this the rupture has not descended. Within the last two days a second swelling causing much pain appeared in the upper part of the scrotum.

Physical examination shows a well nourished man, well except for local condition. On inversion of the scrotum an irregular nodular tumor can be felt in the inguinal canal which is very firm and rather tender. Below this in the upper part of the scrotum, there is a swelling as large as a plum of uniform outline and very sensitive. The tip of the finger passed through the inguinal canal above the upper swelling readily enters the abdomen and an impulse on coughing can be readily felt. The

diagnosis of thrombosis with secondary cyst formation in the cord was made.

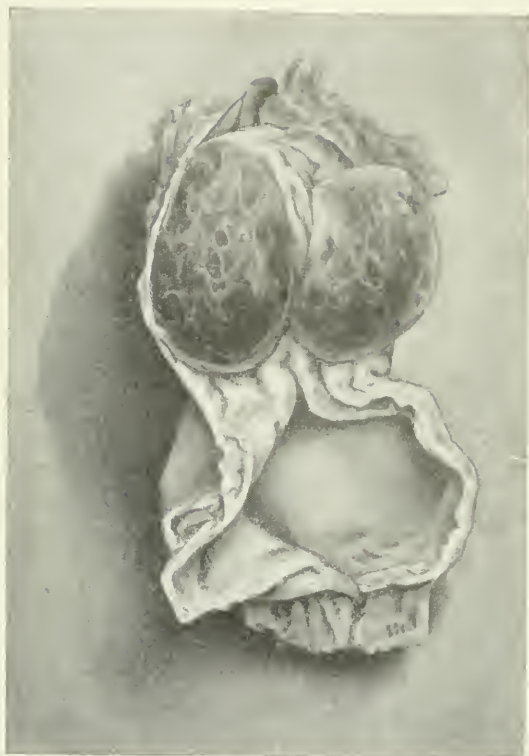
Operation at the Good Samaritan Hospital, December 1, 1906. On splitting the aponeurosis of the external oblique as in the ordinary hernia, there was exposed in the cord a thrombus in process of organization. The vein above the thrombus was patulous. The clot measured an inch and a quarter in length and three quarters of an inch in width. It was of dark red color and of uniform consistence and outline. Below it there was a hydrocele of the cord containing perfectly clear fluid and with a sac of uniform surface and clothed with endothelium. (Fig. 1.) The hernial protrusion of the peritoneum was separated by a considerable interval from the uppermost portion of the thrombus. The thrombus and hydrocele of the sac were easily excised, and the hernia treated in the ordinary way. Recovery was uninterrupted. There has been no recurrence either of the hernia or of the hydrocele.

CASE VI.—Miss R. F., aged 28. Entered the Jewish Hospital, February 18, 1901. Has been well until four months ago, when after a severe strain she felt considerable pain in the right inguinal region. Although it caused her to limp some, it did not keep her from her work as a saleslady. She had quite forgotten this seemingly trifling condition, when about the first of December she noticed a swelling in the groin which gradually increased in size and without any special symptoms. When lying down it disappeared. A physician was consulted who advised the wearing of a truss. She continued to wear this for about two weeks without benefit.

*Physical Examination.*—Well developed young woman, in excellent health except for the local trouble. Occupying the upper part of the right labium majus and the inguinal canal, there is a rounded swelling with long axis parallel to Poupart's ligament. Above the latter nearly to the superior spinous processes a marked fulness is perceptible. On lying down the swelling of the labium disappears either spontaneously or on pressure, and the examining hand on the abdomen can readily feel the distension of the upper portion of the sac. A distinct impulse on coughing exists. With the patient standing, the translucency of the labial part of the sac is easily demonstrable.

The diagnosis of hydrocele of the round ligament was made.

FIG. 1.



Thrombus of spermatic vein. Sac below. (Case 5)

FIG. 2.



Bilocular cyst of round ligament ; Thrombus. Larger part of sac intraparietal. (Case 6.)

The operation was performed on February 19, 1901. The sac was easily exposed and appeared lobulated by reason of its constriction at the ring. The labial portion of the sac was easily enucleated. The intra-parietal portion, however, was deeply adherent to the parietal peritoneum from which, however, it was dissected without wounding the latter. Its firmest connection was with the round ligament where a firm reddish cord, still seen in the specimen, may have been what remained of the thrombosed vein. (Fig. 2.) After the operation, the cyst which appeared bilocular before, was shown to be unilocular. It was very thin walled and evidently of the round ligament. The operation was concluded as an ordinary hernia.

That the obstruction and thrombus formation is oftener in an omental vein than the spermatic is evident from the relative frequency with which cysts are found in connection with irreducible hernias. A mass of omentum adherent at the neck of the sac, or an obstructed appendix will not infrequently be found associated with the separation of a part of the hernial sac from the larger portion above and the effusion into it of a serous liquid. What comes on in a rapid way in a strangulated omental hernia during the first few hours is of slow development in these chronic cases. In the latter there is never any admixture of the fluid with blood. Quite recently I saw a young man with a hernia which had been retained by a truss. A few weeks before he came for observation a rather large swelling formed just without the external ring. It was as large as the end of the thumb, smooth in outline and ovoid in shape. It was distinctly translucent and irreducible. In the inguinal canal there could be felt an irregular mass seemingly a protruded fold of omentum which had become adherent.

In contradistinction to these cases of cysts of the inguinal canal and of the upper portion of the spermatic cord, which in my judgment are the result of either venous obstruction or of thrombosis, are the cases in which the history of trauma or of a pre- or co-existing hernia cannot be obtained. These are cases in which the cysts of the spermatic cord or of the round liga-

ment develop quickly, and at times with symptoms violent enough to suggest a hernial strangulation.

An analysis of the cases which have come under my observation and of which I have four specimens, shows them to be thin walled, lined with a flattened epithelium and containing a clear fluid, characteristic of the ordinary hydrocele (Fig. 3). The question arises whether in cases of ordinary hydrocele of the cord anything else can enter as an etiological factor than the embryonic rests of the vaginal process from the peritoneum through which the testicle descends or the round ligament passes.

So far as I know, the theory that these cysts may be overgrowths from vestiges of the Wolffian bodies, has nothing to support it. It is questionable, too, whether a hydrocele can occur in the cellular tissue of the cord or of the round ligament, without any preëxisting virtual cavity such as a partly obliterated vaginal process. In women particularly it has been questioned whether a hydrocele of the canal of Nuck is an anatomical possibility. The studies of a number of German anatomists seem to have established the existence of such a process. Although its patulousness is far less common than it is in male children, Bergmann found it open along its entire length in five and partly so in twelve subjects between one month and three years old. Furthermore, it is unusual for cysts, except as a result of trauma, to develop in cellular tissue. The analagon of a hydrocele in the neck is nearly always a branchial cyst. Cysts in the inguinal canal, unless formed in a sequestered portion of the sac of a hernia, with or without thrombosis as an etiological factor, are practically always the result of an exudation into the preëxisting unobliterated portion of the vaginal process. That most of these cases occur in the young is explained on this basis. That it may occur in the old is shown by the following case:

CASE VII.—D. L., male, aged 61, was well until a year ago when there appeared a swelling in the right inguinal region. With ordinary symptoms of a reducible hernia there gradually

FIG. 3.



Simple cyst of the spermatic cord. (Scrotal.)

FIG. 4.



Conglomerate inguinal cyst of the spermatic cord (Case 7.)

developed an irregular growth in the inguinal canal and projecting into the scrotum. For about six months before the patient came under my observation the mass had become irreducible.

*Physical Examination.*—Very well preserved and rugged man without other blemish than the local condition referred to. Occupying the region of the inguinal canal and the upper part of the scrotum there is an irregular mass elastic to the touch and presenting a distinct impulse on coughing. It was entirely irreducible. Because of the ease with which the mass was shown to be translucent, the diagnosis of hydrocele of the cord was made. The operation at the Good Samaritan Hospital March 28, 1898, revealed a cyst conglomerate extending within the abdominal cavity and pushing the peritoneum before it. (Fig. 4.) The individual cysts varied in size from a peach to a bean, but did not communicate with each other. They were filled with a particularly clear fluid and were lined with the flattened endothelium of serous sacs. The operation was completed as an ordinary hernia.

It is impossible to state what, without the history of an injury, could have caused an effusion into these embryonic peritoneal rests after more than sixty years of an innoxious desuetude. A case has been recorded by Cenas (quoted by Broca) in which during an attack of acute articular rheumatism a hydrocele of the spermatic cord developed which completely subsided with the disappearance of the general infection. My patient did not have rheumatism.

It is rather difficult to account for the multilocular development of the cyst in the case presented. It is not unlikely that vestiges of the vaginal process, irregularly distributed along the cord, developed simultaneously into separate cysts without communicating with each other or with the general peritoneal cavity. It is characteristic of a true hydrocele of the spermatic cord that it has not any communication with the peritoneal cavity in contradistinction to the open hydrocele, which rapidly or slowly may empty itself into the abdomen and disappears. A seeming reduction of the tumor into the abdomen may take place in the true hydrocele of the cord or round

ligament, when as in case six a large portion of the cyst is above the internal ring and yet on the outside of the peritoneum between it and the muscular portion of the abdominal wall in front. These are the so-called bilocular hydroceles, a part of which appears in the labium or the upper portion of the scrotum and the other portion above the internal ring, and yet separated from the abdominal cavity by an intact peritoneum. It appears that in these cases by the upward growth of the true cyst, the parietal peritoneum is dissected away from the anterior wall in front much as it is in the intra-parietal forms of hernia. Indeed, in many of the cases of bilocular hydrocele hitherto recorded, there has been found, as in properitoneal hernias, some anomaly of position of the testicle. Diverticula of the vaginal process added to the great mobility and ease of displacement of the peritoneum about the internal ring, will readily account for the disappearance of the bilocular inguinal hydrocele. Its appearance during early life and in the young supports the view that in many cases there is an anatomical congenital anomaly as a basic factor.

In the above considerations, cysts of the lower part of the cord and those in conjunction with the testicle have not been considered. Like the organ of Giraldes, an embryonal rest of the Wolffian body, cysts may develop in connection with the upper part of the epididymis from this structure. They never, however, extend to the inguinal canal and are closely fixed to the testicle.

Nor has more than reference been made to the cysts of the inguinal canal and the upper part of the scrotum, which are due to the sequestration of a portion of a hernial sac and the accumulation within it of a serous transudate. The condition of a hydrocele in a part of a hernial sac is often enough encountered and thoroughly understood.

The diagnosis of thrombosis and of hydrocele of the cord within the inguinal canal and projecting beyond the external ring ought under ordinary circumstances present no difficulties. In the cases of thrombosis above described the diagnosis was easily made, and in the hydroceles which followed or developed

without preëxisting thrombosis, the light test sufficed to clear up any doubt which might have existed. Nevertheless, thrombosis of the spermatic veins and an acute hydrocele may set on with such severity of symptoms as to simulate almost in every particular a strangulated hernia. In exceptional cases too, a differential diagnosis between thrombosis of the cord and thrombosis of an omental protrusion cannot be positively made until the parts are exposed by operation. Fortunately in either event an error in diagnosis would only accrue to the benefit of the patient in that an early operation would be insisted upon and probably performed.

The treatment of the conditions under consideration is simple enough. In the milder cases of thrombosis, expectant treatment is indicated. In those of larger dimensions following a trauma or in which from the size of an hematocele a positive diagnosis from hernia cannot be made, an operation is indicated. In hydroceles the older methods of aspiration and of injection have been rightly discarded. Complete excision of the sac is the only advisable procedure. Although in a considerable proportion of cases (as in the bilocular) the enucleation would involve the properitoneal space, the operation does not present insurmountable difficulties. In hydroceles resulting from sequestration of a portion of the sac, the operative treatment is that of an ordinary hernia. It is almost needless to conclude with the injunction that the operation, when complete, must leave the inguinal segment of the abdominal wall as competent to resist pressure as after the ordinary hernia operation.

## COMPARATIVE VALUE OF VARIOUS MEASURES FOR RELIEF OF PROSTATIC ENLARGEMENT.

BY AUGUST SCHACHNER, M.D.,

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IN the pathology of prostatic enlargement, there is usually not enough stress laid upon the trophic changes that occur in the bladder. These changes, the result of the disturbance of the circulation from the bladder, are occasioned by the compression of the valveless vesico-prostatic veins through the increasing growth of the prostatic gland. Usually the attention is directed, almost if not entirely, to the obstructive disturbance exerted upon the urinary outflow. As the result of this venous disturbance the muscular coat acquires connective tissue at the expense of muscular fibres, thereby impairing the contractility and expulsive power of the bladder. Due to this disturbance the bladder, with its impaired tonicity when filled with urine, sags into the pelvis while the neck is firmly held against the pubes by the pubo-prostatic ligaments, in this way forming a retro-prostatic pouch which acts as a reservoir for the residual urine. We have also the formation of trabeculae and between the trabeculae, sacculation through the yielding of the bladder wall. The mucosa by its impaired resistance becomes more sensitive, more susceptible to inflammatory changes as evidenced by the frequent urination.

In the treatment, much depends upon; first, the care with which these cases are selected and prepared for operation; secondly, the rapidity and ease with which they are operated upon, *i.e.*, the shortest time, the least exposure, the most careful manipulation, and the minimum amount of hemorrhage; lastly, the carefulness and gentleness with which these patients are nursed. Old and more or less decrepit, they make constant demands upon the nurse, who is able to influence, not alone the ultimate outcome of the case, but to aid the early convalescence

as well as adding immeasurably to the comfort of the patients during their illness.

The operative procedures for the relief of this condition have been narrowed practically to prostatotomy or the Bottini operation, and to prostatectomy:

Prostatectomy	{	Suprapubic	{	Blind enucleation
		Perineal		Open dissection

Prostatotomy, or the Bottini operation, has played an important rôle in the development of prostatic surgery, and is still an eligible procedure in the extremely old, or especially those afflicted with some serious cardiac, renal, or other underlying trouble, making them undesirable subjects and justifying a temporizing operation. It is the opinion of some surgeons that aside from the cases just indicated it is frequently a desirable procedure in the small, hard, fibrous prostate, which is always difficult of removal, and which, if removal is attempted, should if possible be by the perineal route with an open dissection.

The objections to it as a procedure of general employment are that the incisions made by the cautery are uncertain as to their depth, location or influence upon the gland, and dealing only with the obstruction to the urinary flow, leave untouched that which is equally if not more important, namely, the interference with the venous drainage of the bladder wall. Lastly, as applied to the general class of cases, its mortality is hardly equal to perineal enucleation, which aims at the whole trouble.

The most urgent question in connection with this subject, however, is the choice between the suprapubic and the perineal method. While the most ardent devotee usually concedes that there is a place for the opposite method to the one he espouses, there is frequently hardly enough of this concession. It would be better if there existed a greater desire to see the good in

the other side rather than be blindly absorbed in the advantages of the method elected. However attractive the arguments in favor of one method as opposed to the other may be, the verdict in the end must be determined by the mortality. The surgeon who ignores this, at once assumes the burden of proving that mortality in surgery is but of secondary importance, and of demonstrating why the so-called best operation which he espouses has a higher mortality than the operation which he renounces as not as good.

Statistics can be arranged from many angles, but when we arrange the results of the best operators of the different methods we believe that such statistics represent a fair presentation of the case, especially, when the different statistics of the different investigators are practically harmonious.

The following statistics by Watson (Francis S. Watson, Operations for Prostatic Hypertrophy, *ANNALS OF SURGERY*, vol. 39, p. 855) represent the mortalities of the two methods in the early portion of the recent period of prostatic surgery:

PERINEAL TOTAL REMOVAL.

	Cases.	Death.	Mortality
Goodfellow .....	74	2	
Albarran .....	59	2	
Proust .....	30	0	
Pauchet .....	20	1	
Rafin .....	20	1	
	<hr/>	<hr/>	
	203	6	2.9 per cent.

SUPRAPUBIC.

Freyer .....	45	5	
Moynihan .....	12	1	
Mayo Robson .....	12	0	
	<hr/>	<hr/>	
	69	6	8.6 per cent.

According to Cunningham (John H. Cunningham, Jr., Boston Medical & Surgical Journal, No. 19, 1907, p. 602) the mortalities of the existing methods for the treatment of senile hypertrophy of the prostate are:

	Cases.	Per Cent. Mortality.
Catheterization .....	207	7.7
Palliative operations .....	168	36.9
Partial prostatectomies .....	167	19.1
Bottini operations .....	1289	5.3
Total suprapubic prostatectomy.....	406	9.6
Total perineal prostatectomy—		
1. Dissecting .....	563	5.5
2. Enucleation .....	192	4.7

The following collection of cases is illustrative of suprapubic mortality:

	Cases.	Per Cent. Mortality.
Proust .....	224	12.0
Watson .....	263	13.3
Escart .....	164	18.0
Terney & Chase .....	396	9.8
Freyer .....	205	7.3

Following is a list of the most recently reported cases of the perineal dissecting operations with their accompanying mortalities:

	Cases.	Per Cent. Mortality.
Young .....	150	4.6
Ferguson .....	103	3.6
Albarran .....	73	4.0
Hartman .....	56	9.0
Pauchet .....	53	7.0
Legneu .....	45	8.8
Murphy .....	51	3.9
Rafin .....	32	6.2
Total number of cases .....	563	
Average mortality .....		5.5

#### MEDIAN PERINEAL PROSTATECTOMY—BLIND ENUCLEATION.

	Cases.	Per Cent. Mortality.
Syms .....	34	5.6
Watson .....	54	8.0
Goodfellow .....	78	2.5
Cunningham .....	24	0.0
Total number of cases .....	190	
Average mortality .....		4.7

Freyer (British Medical Journal, Oct. 5, 1907) reports 432 suprapubic operations, with 29 deaths, or a mortality of 7 per cent.

Zuckerkandel (Wiener klinische Wochenschrift, No. 40, p. 1200) reports 60 prostatectomies, 30 by the perineal method, with a mortality of 4 per cent. and 30 by the suprapubic, with a mortality of 7 per cent. This same author has noticed a condition of anesthesia in the posterior urethra that existed in patients after a perineal operation that did not exist after suprapubic operation, showing a nerve injury in the perineal operation that does not occur in the suprapubic.

The statistics are harmonious throughout, namely, that the perineal operation is almost twice as safe as the suprapubic. The other difference noted in studying these statistics is a difference in the mortality between operators of the same class, *i.e.*, different operators doing the suprapubic operation and different operators doing the perineal.

The difference in the mortalities of operators of the same class can be explained on the basis of personal equation, more experience, and lastly, the more careful selection of cases and operative conditions; the latter as proper up to a certain point as it is improper beyond that point. A low mortality is sometimes acquired by denying certain cases the right of surgical relief because their outlook is not promising. The statistics of Cunningham, which indicate a mortality of 5.5 per cent. where the operation consists of the open perineal methods, compared with the more favorable mortality of 4.7 per cent. where the blind enucleation is practiced, are significant in demonstrating that the simpler and quicker the operation is performed the lower will be the mortality. There are many surgeons who have yet to be convinced that the suprapubic is simpler than the perineal. That less important structures are divided, that less hemorrhage is encountered, that less injury to the bladder is sustained, that drainage is better, convalescence shorter and fistulæ rarer in the suprapubic than in the perineal. We are inclined to suspect that the reverse is true even though trustworthy men have done the suprapubic

enucleation in two minutes or less whatever that may mean, and we further suspect that because the reverse is true the mortality is higher.

There has been a difference of opinion among the operators favoring the perineal method as to whether the gland should be removed by blind enucleation or through an open dissection. Those favoring the open dissection contend that the blind enucleation is opposed to well-grounded surgical principles in that the work is done in the dark, and that by this method there is a needless sacrifice of the ejaculatory ducts.

It would seem that this question would depend more upon the age and vigor of the patient than upon the two objections just enumerated. While good exposure of the operative field is a well-grounded principle in surgery, experience proves that the advantages gained by the free exposure are offset by a higher mortality which can only be explained on the ground of more time, exposure and manipulation. Furthermore, results prove that exposure to ocular inspection is not necessary to obtain satisfactory results.

As to the second objection, the needless sacrifice of the ducts, we might with justice speak of this as making, in the majority of instances, "the most out of the least," particularly where the subject is an old one. Blindly enucleating the gland does not necessarily mean the destruction of the ducts, any more than open dissection necessarily means the conservation of the ducts, although we are always prepared to lose them in the blind method; and expect to save them by the open dissection. The potency which these subjects as a rule possess is at a very low ebb, if it exists at all, and if we preserve this, which we admit should be attempted in the younger class of cases, it must be remembered that the subject is expected to be sterile if a total enucleation of the gland is carried out; and the teaching of the functions of the prostatic secretion is accepted.

The chief factors in the mortality are uraemia or renal insufficiency, sepsis, shock, and post-operative and pulmonary complications which Watson arranges in frequency as follows:

	Per Cent.	
Bottini .....	2.70	" "
Perineal operations .....	35.0	" "
Suprapubic " .....	34.0	" "
		} Uremia (or renal insufficiency)
Bottini .....	52.0	" "
Perineal operations .....	17.8	" "
Suprapubic " .....	8.6	" "
		} Sepsis
Bottini .....	5.0	" "
Perineal operations .....	21.4	" "
Suprapubic " .....	30.0	" "
		} Shock
Bottini .....	8.0	" "
Perineal operations .....	17.8	" "
Suprapubic " .....	22.0	" "
		} Post-operative pulmonary complications

There is scarcely any difference in the degree of danger between the perineal and the suprapubic operations so far as uraemia or renal insufficiency goes, and not a very great difference between these two and the Bottini operation. As to sepsis the mortality is about seven times greater in the Bottini than it is in the suprapubic, and about twice as great in the perineal as it is in the suprapubic. This can be explained by the better drainage, not so far as the urinary element is concerned, as better drainage of the secretions accumulating in the cavity from which the prostate has been enucleated.

Deaver (in the *Pennsylvania Medical Journal*, No. 11, v. 10) says: "The prostate lies upon the triangular ligament and above the aponeurosis of Denonvilliers; neither of these structures so important in completing the floor of the pelvis, is divided when the prostate is lifted off them and delivered into the cavity of the bladder. This explains the difference in the percentage of sepsis in the three procedures, and to a large extent likewise explains some of the better end results through the suprapubic method, such as less disturbance of the control."

As to the question of shock, these tables show 5 per cent. for the Bottini, 21.4 per cent. for the perineal and 30 per cent. for the suprapubic, pointing unmistakably to the operation having the most and the least operative interference.

Under the head of post-operative complications we have

8 per cent. for the Bottini, 17.8 per cent. for the perineal and 22 per cent. for the suprapubic. These figures are readily explained on the basis of the Bottini requiring little or no time in bed and the suprapubic requiring the longest time and consequently attended with the highest per cent. of post-operative complications.

The ease and rapidity with which the prostate can be enucleated by either the suprapubic or perineal method has been a strong temptation to its total removal at one sitting and thereby remove the offending member. We believe with Chetwood, Cabot and others that there are some cases that could be more successfully handled if dealt with in two stages. In extremely old and feeble, or where the bladder condition is unsatisfactory, a preliminary cystotomy followed in ten days or two weeks by enucleation will be attended with more successful results than if dealt with by one move as Cabot (*Boston Medical & Surgical Journal*, Oct. 24, 1907, p. 556) very tersely suggests, "if the preliminary cystotomy kills, a prostatectomy would have been foolhardy. If the patient recovers from the little blow, he usually rapidly gains strength; the prostate become less congested, the cystitis disappears and we have procured a change which usually permits a successful enucleation later."

## CONTRIBUTION TO THE SURGERY OF THE PROSTATE.\*

A. THE RESTORATION OF VOLUNTARY CONTROL OF THE URO-GENITAL SPHINCTER  
IN CASES OF INCONTINENCE OF URINE FOLLOWING OPERATIONS UPON  
THE PROSTATE. B. AN OPERATIVE DEVICE IN THE TREAT-  
MENT OF URETHRO-RECTAL FISTULÆ.

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THE mechanism of the urinary incontinence which occurs sometimes after operations upon the prostate is imperfectly understood. This is very largely the result of ignorance of the physiological mechanism which presides over urination. An examination of the various standard works upon medicine and surgery sheds little light upon this subject, but rather adds to the difficulty, owing to the conflicting statements made therein without adequate explanation.

I question very much whether it is possible from our present knowledge to write a strictly accurate description of the complex physiology of the urinary act. It is certain, however, that much of the confusion which now exists can be removed.

I have endeavored in another place to give as clear a description of the physiology of urination as our knowledge of this complex process permits. I purpose in this paper to present some observations in regard to the cause of certain forms of incontinence of urine and to describe a method of treatment which I have employed for its relief and which I think has not heretofore been suggested.

The class of cases to which I desire to call attention are those in which there is a more or less complete inability to

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retain urine in the bladder owing to partial destruction of the urogenital sphincter, or of its attachments, caused by surgical operation.

During recent years the popularity of prostatectomy in the treatment of obstructive prostatic disease, and the prevailing belief that any surgeon, no matter how limited his experience or knowledge, may perform these operations, has multiplied these cases manifold. I say this advisedly because during the past three years more cases of this kind have been admitted into the service under my charge at Bellevue Hospital than heretofore.

These patients were operated upon in other hospitals, and as a result of the manner in which the operations were performed, their condition was made worse, and ultimately they were transferred to Bellevue Hospital. Many of them according to popular standards could be classed only among the hopelessly incurable.

In some of these cases the obstructing portion of the prostate had been only partially removed, and sufficient obstruction remained to require a second operation for its removal. In other cases the anterior wall of the rectum had been torn and there were at the time of their admission to the hospital large urethrorectal fistulæ. The perineum in these latter cases was little more than scar tissue owing to ineffectual attempts to repair the damage.

In most of these cases there was a more or less constant leakage of urine either into the rectum or through the perineal fistulæ which remained open, or through both. In other cases, although the prostate had been removed, so much damage had been done to the urogenital sphincter that there was more or less constant dribbling of urine through the urethra.

As most of these patients were advanced in years, weakened physically by disease, and by a prolonged convalescence after serious surgical operations, the prospect of any ameliora-

tion of their symptoms seemed remote. The treatment of these cases, however, was undertaken, with a determination to spare no time or pains to accomplish a cure.

We may for convenience divide these cases of incontinence into two classes, viz. :

- a.* Those complicated by urethrorectal fistula.
- b.* Those not complicated by urethrorectal fistula.

The cause of the urinary incontinence in all of these and similar cases is, I believe, due to more or less destruction of the fibres of the urogenital sphincter muscle, or to a malposition of the attachment of the fibres of parts of this muscle so that they can act only at a disadvantage. The coordinate action and reaction which normally exists between the intrinsic muscle of the bladder and the sphincter is therefore disturbed. It will be found that incontinence of urine occurs most frequently when the roof of the prostatic urethra and with it the arch which the urogenital sphincter forms in front of the canal is damaged. It occurs also more frequently in those individuals who have naturally a more or less atonic muscular mechanism.

The principle of treatment is:

1. To restore when necessary the perineum, the rectal wall and the urethra to a condition as nearly approaching the normal as possible.
2. To teach the individual by exercise, to use what remains to him of the urogenital sphincter muscle, so that he may acquire voluntary control over the retention and expulsion of urine.

When the control of urination by voluntary effort is attained, automatic control will follow as a physiological necessity.

Any atonic or damaged muscle may be made to act, and the power of its action gradually increased by proper exercises.

It is the method of application of these principles of physiology to the act of urination that constitutes the virtue of our treatment.

## THE OPERATIVE TREATMENT OF URETHRORECTAL FISTULÆ.

The closure of urethrorectal fistulæ is looked upon as one of the most uncertain and unsatisfactory of operative procedures. The difficulty of keeping the line of sutures free from infection and of effectively draining the bladder, make a failure of these operations the rule rather than the exception. It is therefore a satisfaction to be able to report that I have so far overcome the difficulties formerly encountered, that I have been able to close these fistulæ permanently by a single operation, and by methods which while they require experience and careful nursing, can be successfully employed by any competent surgeon.

It is necessary in these cases of urethrorectal fistula following prostatectomy to determine first, whether all obstructing portions of the prostate, especially all intravesical projections, have been removed, and whether the bladder is free from calculi. I mention these facts because I have met with cases in which not only was the prostatectomy incomplete, but in which calculi, and in some instances encysted calculi were found in the bladder.

When these conditions are present they should be removed, and the prostatic urethra and vesical orifice should be made even and smooth to the touch before an attempt is made to close the urethrorectal fistula.

To close the fistula the patient is prepared by a few days' purgation with castor oil and the bowel is washed out thoroughly at the time of operation.

With the patient in the lithotomy position a curved incision is made in the perineum in front of the anus, extending from one tuberosity of the ischium to the other; the central portion of the perineum is divided and the dissection is carried upward between the rectum and the prostate so as to expose the wall of the rectum externally for at least  $\frac{1}{2}$  inch above the upper margin of the fistula.

This dissection is to an inexperienced surgeon difficult; for after the prostate has been removed the tissues are very

thin between the rectum and the urethra. It will be found that more space in the perineal wound can be obtained by dividing the origin of the transversus perinei muscles from the ischium, or at least the more superficial part of these muscles.

The edges of the fistula should be separated from the urethra by cutting with a sharp knife and scissors and not by blunt dissection. The edges of the urethra at the seat of the fistula should be carefully refreshed by cutting away all overgrowing mucous membrane from the urethra, but the urethra should not be sutured.

The tissues about the fistulous opening in the rectal wall are then refreshed with curved scissors and made smooth. All hemorrhage should be stopped and the wound made as dry as possible. The opening in the rectal wall is then closed by interrupted Lembert sutures of chromicized catgut placed from the perineal side by means of a round curved needle. These sutures should not include the mucous membrane of the bowel. One suture should be placed well above the upper margin of the opening and one well below the lower margin. It will be found convenient to introduce the sutures from below upward, and not to tie any suture until all have been placed.

After the opening into the rectum has been closed the bladder and bowel are to be irrigated by means of a metal tube. During this process the bowel should not be distended. No drainage tube is put into the bladder.

To protect the line of suture in the rectal wall I have devised the following expedient: A small triangle of gauze consisting of six or eight layers is made to fit the wound. The apex of this triangle is carried by forceps up to and behind the vesical orifice. Between the layers of gauze, a 10 per cent. iodoform ointment, made with vaseline, is then injected from a glass syringe and the little pad is then plastered down so as to fit the posterior surface of the perineal wound accurately.

As the urine flows from the bladder over this pad it is shed off this as water is from a duck's back.

The gauze is to be changed twice or three times a day, or oftener if the pad becomes displaced.

The external wound is then dressed by gauze pads to absorb the urine as it flows out of the wound.

I have usually confined the bowels by the use of opium for one week, and have then given a dose of castor oil and have superintended the giving of an enema at the time of the first movement.

On each day during the first week I introduce into the rectum a metal tube and wash out the lower bowel without distending it, and then inject into the rectum about one or two drachms of iodoform ointment. I am now able uniformly to get solid union of these fistulæ. It requires, however, attention to minute details and good nursing and careful watching. The results are a full compensation for the work.

The perineal wound is given the most careful attention during cicatrization so that it will fill in from the bottom without fistula. Sounds are passed after the first ten days as they may be required to keep the urethra free from stricture and to make its walls smooth.

#### THE RESTORATION OF VOLUNTARY CONTROL OF THE UROGENITAL SPHINCTER.

After restoration of the rectal wall and of the perineum these cases of urinary incontinence come into the second division of our classification and are to be treated as the cases of incontinence not complicated by urethrorectal fistula.

Every surgeon who has had extensive experience in the performance of prostatectomy has encountered these cases, and the occurrence of this disability has frequently been presented as an argument against the operation. Happily the great majority of cases of prostatectomy skilfully done do not suffer from this disability. But there is a sufficiently large number that do so suffer and so far as I know no adequate method of treatment has heretofore been suggested.

The method which I now present has had an extensive

trial during more than three years and the results which have been obtained have justified our most sanguine expectations.

I had the honor to show to the Society of Clinical Surgery at their meeting in New York last October a large number of the cases which form the basis of this paper, and give a practical demonstration of the method of treatment by which these patients had been cured.

This inability to retain the urine as I have said may be more or less complete and I have seen the following different degrees:

1. There may be what is practically if not literally a complete incontinence. The action of the urogenital sphincter seems to be abolished and the urine almost as fast as it flows from the ureters into the bladder, flows out through the urethra, drop by drop. The flow is usually intermittent, and corresponds to the intermittent flow from the ureters.

2. The bladder may be able to retain a small quantity of urine, but when this amount is exceeded there is leakage.

3. The leakage may be intermittent, occurring at certain times during the day. There is often no leakage during sleep, nor for several hours after rising in the morning, but toward evening when the patient becomes physically tired, there is more or less incontinence.

4. The patient may have perfect control while sitting or lying down, but when standing or walking, there is involuntary leakage.

5. There may be leakage immediately after the urinary act, caused by retained urine in the urethra as the result of an atonic condition of the urethral walls.

These different degrees of disability are subject to infinite variation.

The effect of this inability to retain the urine, upon the minds of men naturally feeble, or made feeble by sickness and by disappointment, is often lamentable. And it is very necessary to arouse in the minds of these patients the hope that their disability is not a permanent one. The influence of suggestion here is undoubtedly great, and no time or pains should

be spared to impress them with the reasonableness of a promise to cure them. This is essential, because without the hearty and intelligent coöperation of the individual patient a cure is impossible. On this account and to accomplish the best results, I have adopted the plan of treating several patients together in the hospital; so that those who are beginning to be taught to gain urinary control may be encouraged by those who have been taught, or who are at least further advanced toward a cure than they themselves are.

The method of instruction must vary with each case, but a general idea of the plan pursued in most cases may be given in outline.

The principle of treatment is to make the individual learn by practice to exercise voluntary control over what remains of the urogenital sphincter, thus to prevent the escape of urine. If this can be done, automatic control follows as a physiological necessity.

The difficulties to be overcome are greater than they might at first seem because in some of these cases there has been a very extensive destruction of the urogenital sphincter, by the improper performance of the prostatectomy. Yet even in the seemingly hopeless cases it is surprising to find how readily the parts remaining of this complex muscular mechanism which we call the urogenital sphincter may be trained to compensatory work.

The first step in accomplishing this result is to accustom the individual to moderate bladder distention. A catheter is introduced through the urethra and a warm saline solution is injected. The quantity injected should be just short of that sufficient to excite vesical contraction and a desire to pass urine. The catheter is then closed by the finger and the individual is instructed and urged to exert himself to retain his urine; this is continued for several minutes; then continuing to urge the patient to "hold his water" the catheter is withdrawn. The fluid from this bladder is usually at first expelled, but the patient is urged during the entire time to prevent its escape.

This procedure is repeated several times and with varying quantities of fluid.

After a few days it will be found that the ability to retain some of the fluid injected is acquired. This fact should be pointed out to the patient and he should be encouraged in his efforts. He should be instructed to make voluntary effort to control the escape of urine whenever he can.

After he has acquired the ability to control the injected fluid in the recumbent position, he is taught to control it when moving, when getting out of bed, when sitting down and when performing certain mild calisthenic exercises, as raising first one foot, then the other foot; sitting down and then arising. These actions are at first done with deliberation, then more rapidly.

In order to prevent leakage it is important to see that the urethra is completely emptied after each act of urination. In old men whose muscular structures are relaxed, or in whom the accelerator urinæ muscle has been injured the urethra does not empty itself and the presence of urine in the canal excites the contractility of the bladder and causes dribbling of urine. The patient is instructed to press upon the perineum with the fingers and to strip the urethra after each act of urination.

As soon as he has acquired any voluntary control, he should be instructed to urinate at frequent intervals and each act of urination should consist of an exercise of interrupted urination, viz., to begin the act, to cut off the flow; to begin again, to control the flow.

At first all of these exercises must be done under supervision; and the rapidity with which the results are obtained will depend in a measure upon the intelligence of the individual and his coöperation in the treatment. An ignorant, discouraged, sulky old man is hard to teach; but it can be done if one gives the time and energy necessary.

# MUSCULO-SPIRAL (RADIAL) PARALYSIS DUE TO DISLOCATIONS OF THE HEAD OF THE RADIUS.

WITH ESPECIAL REFERENCE TO THOSE CASES COMPLICATING FRACTURE  
OF NEW YORK,

BY DE WITT STETTEN, M.D.,

OF NEW YORK

Assistant Visiting Surgeon to the German Hospital.

THE question of injury to the musculo-spiral nerve, perhaps the most frequently affected nerve in the body, has been treated exhaustively in the medical literature, but that particular form due to dislocations of the radial head has been surprisingly neglected. The scant respect shown this important combined lesion which represents a distinct pathological and clinical entity, its comparative frequency and practical significance, and the possibility of a completely successful surgical treatment of the condition have induced the writer to report, in detail, the following case which first came under his observation while he was house-surgeon at the German Hospital, New York. In connection with this report, he has reviewed the literature of the subject, laying particular stress upon those cases complicating fracture of the ulna, and finally, he has made a number of cadaver experiments to determine the anatomical relations of the dislocated radial head to the musculo-spiral nerve.

Patient F. P., printer, aged 19. On August 12, 1903, while the patient was winding a cable of a theatre curtain, the crank slipped from his hand, reversed, and forcibly struck his right forearm. He was unable to use his arm, and a doctor made the diagnosis of fracture of the ulna. The patient states that shortly after the injury he noticed that he could not extend his wrist or fingers, and that the back of the hand and half of the fingers felt numb. The arm was put in a splint, which was worn for four weeks, and when this was removed there was decided impairment of the function of the elbow, while the condition of the

wrist, hand, and fingers was unchanged. These functional disturbances persisted until the patient's admission to the German Hospital, New York, on November 13, 1903, three months after the injury.

**EXAMINATION.**—*Inspection* of the right forearm shows a depression on the ulnar side at the junction of the upper and middle third and a marked prominence on the radial side of the cubital fossa. There is a drop-wrist. The forearm is atrophied and the skin of the dorsum of the hand looks bluish and glossy.

*Palpation* reveals a distinct deformity of the ulna corresponding to the depression and caused by a bowing of the bone, forwards and radially. The fragments are firmly united; there is considerable callus at the point of fracture; the angle formed by the two fragments is about 160 degrees; the upper fragment is displaced inward and backward, the lower outward and forward. The prominence in the bend of the elbow is the radial head, resting on the lateral condyle of the humerus. It is slightly thickened. It rotates in pronation and supination. The dorsum of the hand is cold.

*Active Motion. At the Elbow.*—Flexion is limited to about 100 degrees. Extension is unaffected. Pronation and supination are somewhat restricted, particularly the latter.

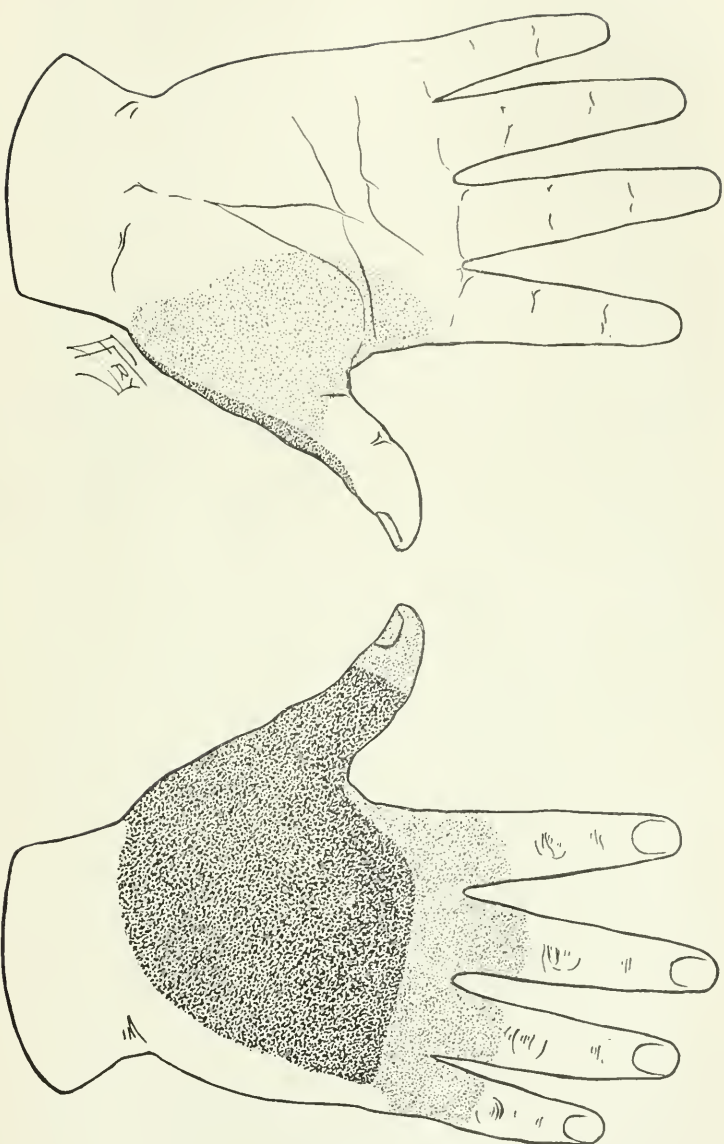
*At the Wrist.*—Flexion is normal. Extension is only possible for about 15 degrees from the drop-wrist position. Abduction is slightly limited. Adduction is not impaired.

*At the Fingers.*—Flexion is normal. The proximal phalanges and the thumb cannot be, while the two distal phalanges of the four fingers can be extended. The abduction and adduction of the four fingers are normal, but the thumb cannot be abducted.

*Passive Motion.*—Flexion, pronation, and supination at the elbow are limited to the same extent as the corresponding active motions. Forcing produces considerable pain. Extension of the elbow and all the movements of the wrist and fingers are passively uninterfered with. The patient's grip is weak, but is somewhat strengthened on passive extension of the wrist.

*Sensation.*—There is practically a total loss of sensation of the entire dorsum of the hand which extends to the phalangeal joint of the thumb and almost to the metacarpo-phalangeal articulations of the fingers. This area of anaesthesia reaches nearly to

FIG. 1.



Areas of anesthesia. Dark shading—practically total anesthesia. Light shading—impaired sensation.

FIG. 2



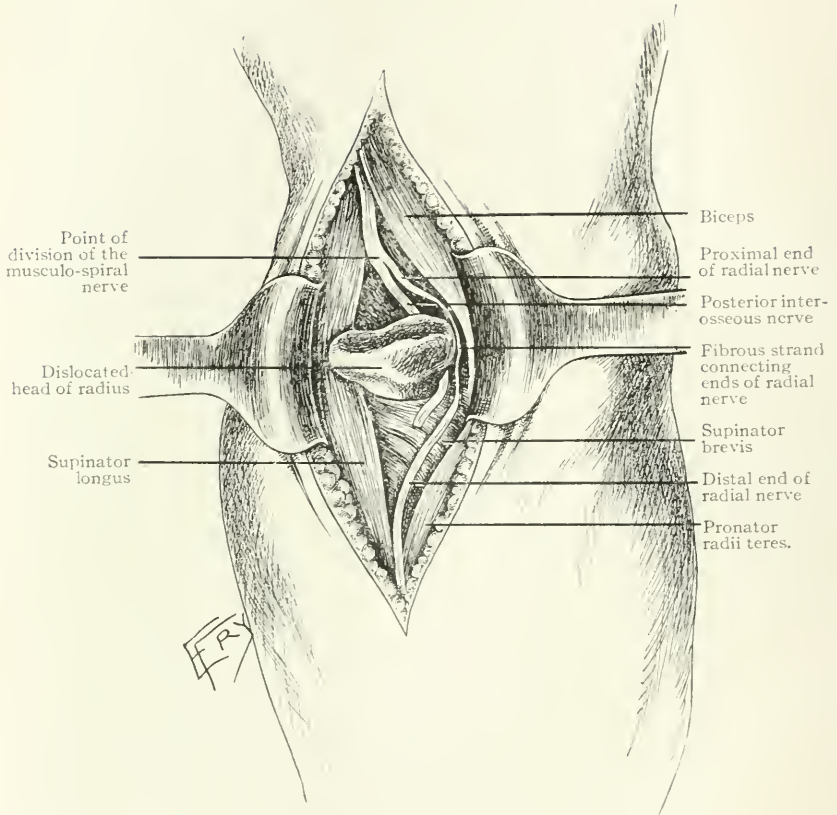
Skiagram before operation. Flexion. Lateral.

FIG. 3.



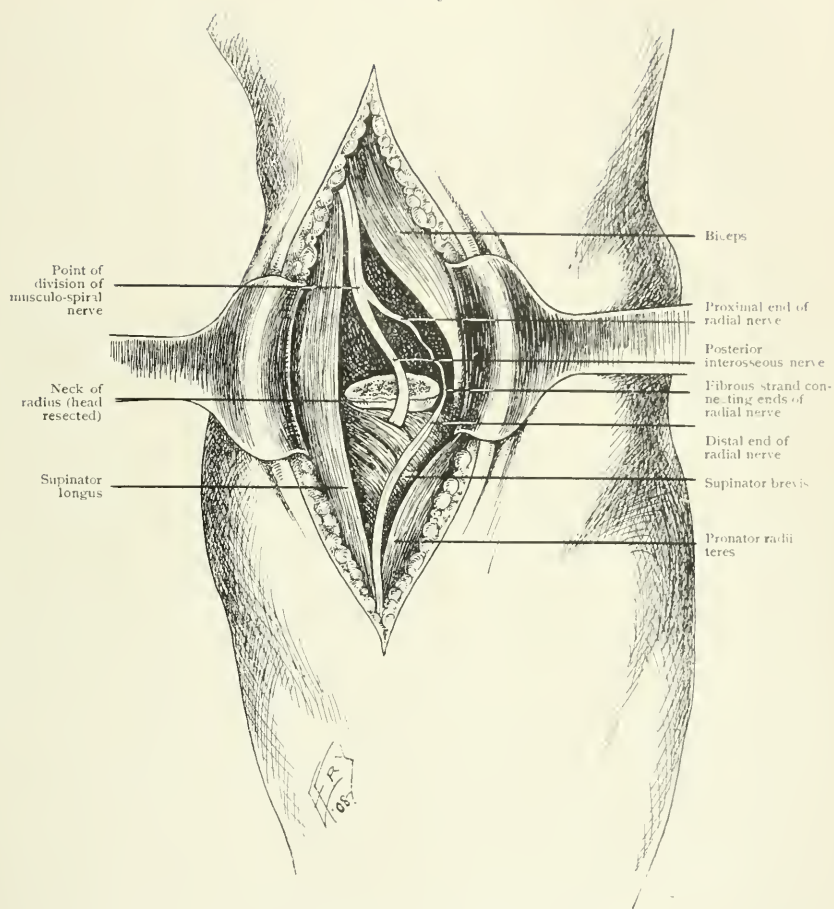
Skiagram before operation. Extension. Anteroposterior.

FIG. 4.



Condition at operation.

FIG. 5



Appearance after resection of head of radius.



the wrist. On the ulnar side of the back of the hand there is a narrow strip of normal sensation. The dorsal surfaces of the distal phalanx of the thumb and the proximal phalanges of the fingers show impaired sensation, as does the thenar eminence. (See Fig. 1.)

*Electrical Reactions.*—There is a total loss of faradic contractility of the extensor communis on direct stimulation. This muscle is more excitable to galvanism, and A. C. C. > K. C. C. On stimulating the musculo-spiral nerve in the arm, the extensor communis reacts neither to faradism nor galvanism, but the extensor carpi radialis longior and the supinator longus react normally.

*Mensuration* shows—

	Right.	Left.
Ulna—Styloid process to olecranon.....	24 cm.	25.5 cm.
Radius—Styloid process to epicondyle.....	26 cm.	28 cm.
Circumference of forearm 5 cm. below olecranon.....	22 cm.	24.5 cm.

There is a shortening of the ulna of 1.5 cm. and an apparent shortening of the radius of 2 cm. The atrophy of the forearm is 2.5 cm.

*Radiographic examination* shows a fracture of the ulna at the junction of the upper with the middle third and a dislocation of the head of the radius forward and slightly outward. There is a moderate deformity of the fractured bone consisting in a bowing forward and outward, the lower fragment overriding the upper and lying internal to it. There is bony union with a fair amount of callus. (See Fig. 2 and 3.)

The diagnosis of the bone and joint lesion being evident, there still remained to be considered the exact nature and site of the nerve lesion, and what measures should be taken to increase the usefulness of the extremity. There was no doubt that there existed a musculo-spiral paralysis, and it was finally decided that this was due to a contusion or a laceration of the nerve, probably produced by the dislocated radial head. It was further concluded that the nerve was probably injured below its bifurcation into the posterior interosseous and radial as it was distinctly observed that the extensor carpi radialis longior, and especially the supinator longus, were not paralyzed. These muscles are supplied before the nerve divides.

The attempt at bloodless reduction of the old dislocation naturally failing, operation was decided upon with the following indications:

- 1st. To investigate and repair the nerve injury if possible.
- 2nd. To increase the flexion of the elbow by either reducing the dislocation or resecting the radial head.

The *operation* was performed on November 19, 1903, by Dr. F. Kammerer.

A 10 cm. longitudinal incision was made directly over the prominent head of the radius. The supinator longus was exposed, and just medially was seen the protruding radial head which had pushed sharply inward the two divisions of the musculospiral nerve. (See Fig. 4.) The head of the bone is somewhat hypertrophied and the cartilaginous surfaces are no longer glossy. Both branches of the nerve are much flattened, and the nerve fibres are apparently ruptured. It seems as if the ends are held together by thin, flat, fibrous strands, the remnants of the nerve sheaths. This is particularly true of the radial branch. After carefully freeing the nerves and pulling them aside, the head of the radius was resected with the Gigli saw and the nerves allowed to return to their normal position. (See Fig. 5.) The wound was closed without drainage, the arm was put in semi-flexion, midway between pronation and supination. The patient made an uneventful post-operative recovery. The wound healed primarily. After a month, the plaster dressing which had been applied was removed, and then under massage, passive motion, and electrical treatment the flexion of the elbow and the nerve function were gradually improved. When the patient left the hospital on January 22, 1904, the anaesthesia had greatly diminished, and there was a marked increase in the extension of the fingers and wrist and in the flexion of the elbow. The electrical reactions still showed degenerative changes, but also evidences of marked improvement. Galvanism and faradism to the nerve trunk gave sluggish contractions, as did faradism to the extensor communis. The galvanic response of the muscle was prompt and the A. C. C. > K. C. C. was still present.

The condition of the patient continued to improve, so that at the end of the three years he was practically well. He was last seen by the writer January 18, 1908. He states that for the past

FIG. 6.



Skiagram four years after operation. Flexion. Lateral.

FIG. 7.



Skiagram four years after operation. Extension. Anteroposterior.

year the condition has been stationary and that aside from an occasional trembling of the thumb, a grating at times in the joint on turning forearm, a very slight muscular weakness of the hand, and an insignificant numbness of its back and outer side of the ball of the thumb, there are no subjective symptoms. The patient is easily able to follow his present trade of tinsmith.

*EXAMINATION.*—*Inspection* shows nothing but a healed linear scar in the bend of the elbow. There are no trophic changes.

*Palpation.*—The upper extremity of the radius gives the impression of being the normal head in proper position, rotating under the examining finger. The bowing of the ulna can be felt, but is not striking.

*Motion.*—Flexion at the elbow is almost perfect. Extension is slightly more than normal. Supination and pronation are unimpaired, though passive motion reveals an occasional crepitation in the superior radial joint. There is a very trifling limitation of extension at the wrist and all the movements of the fingers are perfect. The grip is strong.

*Sensation.*—There is slightly impaired sensation of the hand corresponding to the previous area of total anaesthesia. This is most marked on the back of the hand between the first and second metacarpals.

*Electrical reactions* of the nerve trunk are normal. Local stimulation of the extensor communis with the faradic current gives a somewhat sluggish response. The muscle does not appear hyperexcitable to galvanism, but A. C. C. = K. C. C.

*Mensuration.*—There have been no changes in the bony measurements, but the circumferences of both forearms, 5 cm. below olecranon are equal, 26 cm.

*Radiographic examination* shows the upper extremity of the radius rounded and slightly hypertrophied. It is not in contact with either ulna or humerus and seems to lie free in the soft parts. The fracture shows very good union. The angle resulting from the displacement has been filled in by new bone. Superiorly and laterally there is at the site of fracture an apparent hyperostosis, irregularly shaped and of moderate size. (See Figs. 6 and 7.)

Interest in the above case, and the very successful outcome of the surgical treatment, induced the writer to examine the literature of ulnar fracture combined with dislocation of the

head of the radius, particularly in reference to the mechanism, the unity, and the types of the injury, on the one hand, and to the nerve complication, on the other. This in turn led to a series of cadaver experiments which were made with the double purpose of reaching some definite conclusion concerning the former problem, in regard to which, since Malgaigne's original contribution in 1854, there existed a mass of doubt and contradiction, and of studying the anatomical relations of the dislocated radial head to the musculo-spiral nerve, and the frequency with which the nerve is involved. I shall not discuss here the question of the combined bone and joint injury, for I propose publishing the results of my researches in this matter at some future date, but shall devote my entire attention now to the latter subject.

Before discussing that particular point which is of especial interest to us here, namely, musculo-spiral nerve injury as a complication of dislocations of the upper extremity of the radius associated with ulnar fracture, it is important that the following be understood: Those deductions drawn in regard to the typical injury of the nerve in cases of the characteristic combined bone and joint lesion, apply in a certain measure to isolated dislocations of the head of the radius. The difference is simply that the latter class of cases is rarer than the former and hence the neurological complication is seen more frequently with ulnar fracture. Another factor that explains the relatively greater frequency of nerve involvement in the fracture cases, is that a greater dislocation of the head of the radius is possible when the ulna is broken than when it is intact, and hence the musculo-spiral nerve or its branches are more likely to be damaged. I have purposely not considered in my discussion injury to the nerve in dislocations of both bones of the elbow. Here the traumatism to the soft parts is so extensive and diffuse, that to draw a characteristic pathologic-anatomical picture of the lesion were well nigh out of the question, though it is not unlikely that musculo-spiral injury even in these instances could occasionally be grouped with the typical cases.

## RESUME OF THE LITERATURE.

The first distinct reference to the nerve complication is made by GRENIER<sup>1</sup> in 1878. In his thesis on fracture of the ulna, combined with dislocation of the radius, he casually notes in reporting one of his cases that the patient suffered from an extensor paralysis which yielded to electrical treatment. The forward dislocation was never reduced.

The second case is DOERFLER'S<sup>2</sup> (1886) of complete and permanent paralysis of the extensors in an old unreduced outward and slightly backward dislocation of the radius, with compound fracture of the ulna. He gives an utterly hopeless prognosis in cases of nerve injury.

The third report is by WINNET<sup>3</sup> (1894) of a four weeks' old forward and outward dislocation, with fracture of the ulna and a posterior interosseous paralysis. There are no data given as to the outcome of the nerve injury.

The fourth time that this lesion is recorded is by ANNEQUIN<sup>4</sup> (1898). He gives a detailed account of a case of a month-old forward and slightly outward dislocation with ulna fracture, in which the motor power of the hand was diminished, several anaesthetic zones existed on the hand and forearm, the hand was moist and cold, and the nails showed trophic disturbances. Extension of the elbow caused painful radiations along the radial branch. This is the first case in which both motor and sensory branches were involved, and both incompletely. Resection of the head of the radius brought about a complete restoration of function.

ALBERTIN<sup>5</sup> (1898) gives us the fifth clinical report of this injury. The patient sustained a fracture of the ulna at its middle, with a forward dislocation of the radius. A musculo-spiral palsy developed at once. The radial head was resected and the paralysis gradually disappeared.

The sixth record is SCHAEFER'S<sup>6</sup> (1899). In this case, due to a forward dislocation of the radius complicating an ulnar fracture, there developed an immediate complete anaesthesia of the hand with total flexor and extensor paralysis. An injury to the median, ulnar and musculo-spiral nerves was assumed, and operation fifteen weeks after the injury, consisting in freeing the nerves from their bed of scar tissue, resulted in a complete recovery seven months later.

The seventh observation is made by WILMS<sup>7</sup> (1903), who incidentally remarks that the musculo-spiral nerve was paralyzed in a case of forward and outward dislocation, with fracture near the middle. The case comes from the Trendelenburg clinic and a skiagram is reproduced. No details are given.

The eighth and last reported case is one of Le Dentu's, quoted by MARSAN<sup>8</sup> (1906). The patient sustained a fracture of both bones of the forearm and a forward dislocation of the head of the radius. A variety of trophic disturbances ensued. No distinct reference is made to the exact nerve lesions except that it is noted that there was a zone of anaesthesia in the area of the distribution of the radial, presumably due to pressure on the anterior branch of the musculo-spiral by the head of the radius. The cold, violet red hand, the "main-en-griffe," and the

anaesthesia were present at the end of three years and were apparently permanent. The head of the radius was not resected.

The case that the writer has observed is then the ninth recorded case of nerve injury in dislocation of the head of the radius complicating fracture of the ulna. He might state here that the total number of cases of the combined bone and joint injury found in the literature was one hundred and nineteen. He has found but one case of nerve injury in isolated dislocation of the head of the radius.

This is reported by CARREY<sup>9</sup> (1894), who states that his patient had an old forward dislocation of the head of the radius and shortly after the injury developed a musculo-spiral paralysis. There was anaesthesia, mainly on the radial side of the hand, extensor paralysis of the wrist and fingers, with marked atrophy and hyperidrosis. The head was resected on account of limitation of motion in the elbow, and fifteen months later there was a good functional result, though no direct reference is made to the restoration of nerve function.

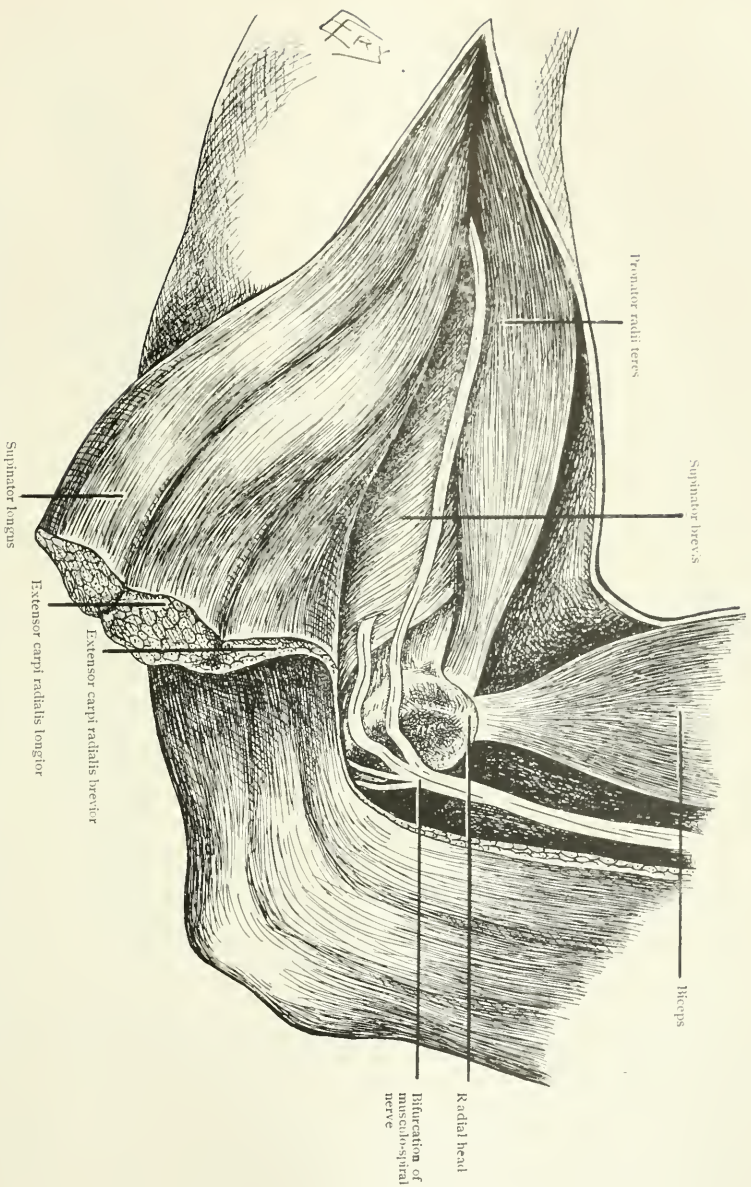
Aside from these clinical records a number of definite anatomical observations have been made, showing that the musculo-spiral nerve is in very close relation to the dislocated radial head.

SCHUELLER,<sup>10</sup> in 1885, first pointed out that the nerve can be stretched just at its point of division by a forward dislocation, and that the deep branch might be involved in other varieties. He demonstrated this by a cadaver experiment and published a picture of the nerve caught by the dislocated head. (See Fig. 8.) The clinical aspect is not considered.

LOEBKER,<sup>11</sup> the next year, substantiated this fact by a number of experiments and also represented the condition graphically. His picture shows the two divisions of the nerve around the neck of the forward dislocated radius. (See Fig. 9). He urges care in operative work on the radial head, advising a lateral incision to avoid the nerve. He admits having almost divided the nerve in one attempt to resect the head and further states that he knows of a case in which a careless operator directly severed the nerve in attempting resection. His remarks refer purely to the surgical anatomy of the situation and he entirely disregards the possible clinical picture.

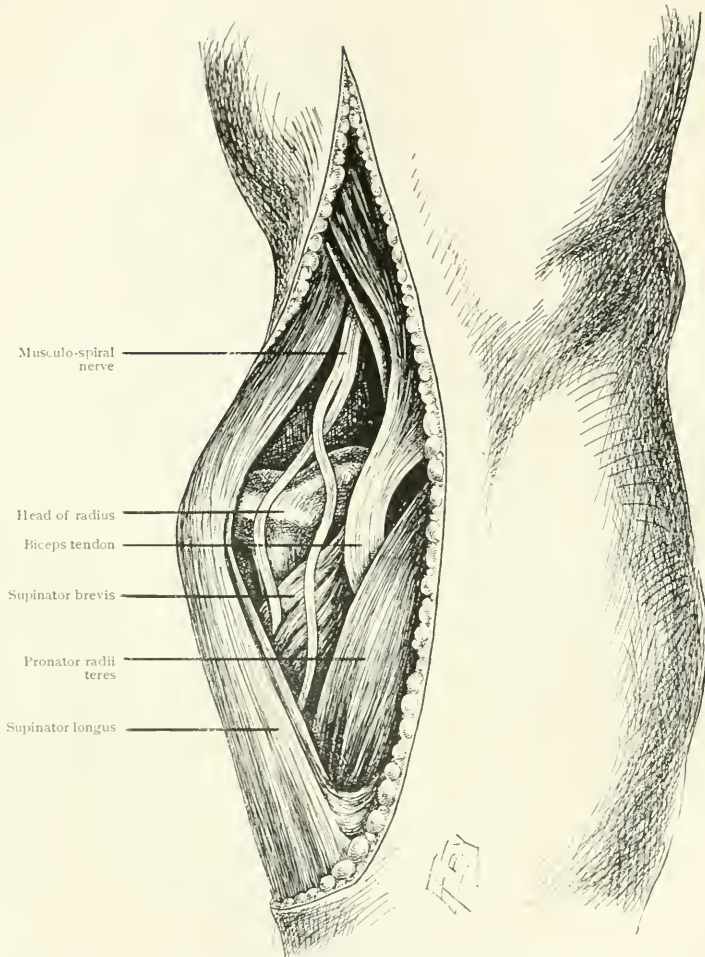
DOERFLER also calls attention to the relations of the nerve to the dislocated head, as he noted them in two of his cadaver experiments. In one forward dislocation the nerve was around the neck of the radius and in another instance of forward and outward dislocation it was stretched over the head just at the point of division. In both cases exaggeration of the dislocation—hypertension—would have torn the nerve.

Fig. 8.



Relation of the musculo-spiral nerve to the forward displaced radial head (after Schneller). Left arm.

FIG. 9



Musculo-spiral nerve around the forward dislocated head of the radius (after Læbker). Right arm. This sketch shows anatomical relations almost identical with those found at operation in the case herein reported.

ANNEQUIN noted in his case that the radial head had lifted up the musculo-spiral nerve and ALBERTIN made a similar observation at the operation on his patient. SCHAEFER also saw this condition though he did not resect, but simply loosened the nerve from the surrounding fibrous tissue.

In spite of these very positive anatomical observations and the fair number of reported cases, musculo-spiral involvement in radial head dislocation with or without fracture of the ulna has been very generally ignored by the medical teachers.

The older general surgeries make no reference to the subject whatsoever. Rieffel in Le Dentu and Delbet's "*Traité de chirurgie*" (1896) calls attention to Grenier's case, and Wilms in the 1907 edition of the "*Handbuch der praktischen Chirurgie*" mentions the lesion in connection with his case quoted above. The latter, however, in his chapter on injuries of the nerves at the elbow and in the forearm totally disregards the question, though he does speak of fracture of the radial head as a cause of the nerve injury. Tillmanns (1898) simply notes the possibility of the nerves being injured in complicated elbow dislocations, while Koenig (1900), though he devotes a separate chapter to injury of the soft parts at the elbow, does not so much as mention the typical lesion. Neither of the two most recent American systems on general surgery (1907) Keen's, and Bryant and Buck's make the slightest reference to musculo-spiral paralysis in elbow dislocations.

Bardenheuer, in his "*Verletzungen der oberen Extremitäten*" (1888), remarks that the deep branch may be compressed in forward dislocations of the capitulum radii, and in his "*Allgemeine Lehre von den Frakturen und Luxationen*" (1907), he merely casually repeats this statement.

Of the special text-books on fractures and dislocations that I have consulted, the older ones, Hamilton (1891) included, contain no allusion to the nerve injury. Stimson (1907), in his chapter on fracture of the ulna with dislocation of the radius, mentions Doerfler's case and notes the possibility of the complication, but under the special heading of nerve injury due to dislocations, he absolutely overlooks the ques-

tion. Helferich, in his "Frakturen and Luxationen" (1906), speaks of musculo-spiral paralysis as a possible complication of anterior dislocations of the upper extremity of the radius, as do Hoffa in his "Lehrbuch" (1904) and Hennequin and Loewy in their "Fractures des os longs" (1904), though none appears to appreciate the fact that the injury is a typical one or to lay any stress upon it. The last two, even, in their latest publication, "Les luxations des grandes articulations" (1908) do not consider the nerve lesion sufficiently important to mention at all.

Stanciulescu, in his dissertation on dislocations of the radius complicating fracture of the ulna (1890), notes that several cases of rupture of the anterior branch of the musculo-spiral have been recorded as due to radial dislocation, and Pascal, in his inaugural thesis on isolated dislocations of the head of the radius (1907), merely refers to musculo-spiral paralysis in passing. Zieger in his monograph on traumatic dislocations of the radial head (1901) makes a very casual reference to the possible nerve complication.

The text-books and systems on general medicine completely disregard the lesion, and the neurological works treat the subject in about the same manner. Gowers (1895), Dana (1904), Church and Peterson (1905), Oppenheim (1905), and Starr (1907) absolutely ignore radial dislocation as a possible cause of musculo-spiral paralysis, though every other conceivable etiological factor is noted. Grasset and Rauzier (1894) do speak of elbow dislocation as a cause of nerve lesion, but do not specify.

In their monographs on injury of nerves, Weir Mitchell (1872) and Bowlby (1889) both devote a special chapter to injuries due to dislocations, but our particular type is totally neglected. Pearce Bailey's volume of "Diseases of the Nervous System Resulting from Accident and Injury" (1906), likewise contains no allusion to it. Schede and Graff in their article on the surgery of the peripheral nerves in Penzoldt and Stintzing's "Handbuch" (1903) totally disregard dislocation of the radius in the etiology of musculo-spiral

palsy. Bernhardt, in his "Erkrankungen der peripherischen Nerven" (1902), remarks that fracture of the head of the radius can cause nerve injury, but no word on dislocation. He is no more explicit in the volume on nervous diseases of the "Deutsche Klinik" (1906). Chapoy (1874), Biberfeld (1893), and Potain (1896), writing on the special subject of musculo-spiral paralysis, are apparently unaware of the danger of traumatism to the nerve from the dislocated head.

Summarizing the situation it is seen that, while a moderate number of cases have been put on record and several investigators have noted distinctly the anatomical connection between the musculo-spiral nerve and the dislocated head of the radius, the fact that this nerve lesion is a typical and characteristic one, has been entirely overlooked. In fact, the very possibility of the injury is only admitted by an occasional author on general surgery, and perhaps somewhat more frequently by those dealing more specifically with dislocations, though in neither instance is any importance attached to the matter nor its significance appreciated. Absolutely no reference is found to this type of nerve injury among the general medical and neurological writers, be it among those dealing with nervous diseases in general, with nerve injuries in particular, or even with musculo-spiral paralysis exclusively.

Of course, the general disregard of this subject by the medical writers is explainable by the rarity, first of radial dislocation, and secondarily of the nerve complication, but the significance and importance of the latter and its comparative frequency in cases of the joint injury have justified the writer in performing the following cadaver experiments to determine the relations of the nerve to the dislocated head and the regularity of the involvement. As he was also interested in the mechanism of the combination of radial dislocation with ulnar fracture he always produced this type of injury. Further, this is the easiest way of causing a dislocation of the radial head, and finally this was the type of radial dislocation which represented the vast majority of the clinical observations quoted

above and thus the conditions during life were most closely imitated.

#### EXPERIMENTS.\*

EXPERIMENT I.—January 6, 1908. German Hospital. Left arm of medium-sized, middle-aged, female body. Ulna partly sawed through at upper third and forearm bent back over edge of block. Fracture, with forward dislocation of head of radius.

*Dissection.*—After separating the fibres of the supinator longus, both branches of the musculo-spiral nerve, about 2.5 cm. below the bifurcation, are found twisted around the neck of the radius and pushed slightly outward by the head. On reduction of the head the nerve slips off, but on redislocating so that the dislocation is slightly more outward, the two branches are directly lifted up by the head. If the dislocation be exaggerated, the nerves are dangerously stretched and they could even be lacerated by continuing the hyperextension. Flexion of the elbow relaxes the tension on the nerves. A tight bandage, with the dislocation unreduced, would severely crush the nerve against the radial head. On reducing and redislocating further inward the nerves escape.

EXPERIMENT II.—Right arm of same body. Fracture and dislocation produced as above, but in such a manner that the dislocation is somewhat more outward.

*Dissection.*—Separating the fibres of the supinator longus one strikes the two divisions of the musculo-spiral a short distance below the bifurcation stretched over the radial head like violin strings over a bridge. Hyperextending the forearm would tear the nerves. Flexion relaxes them. Simple forward dislocation catches only the radial branch, while more direct outward displacement catches only the posterior interosseous.

EXPERIMENT III.—January 20, 1908. Cornell University. Left arm, exarticulated at shoulder of frail, elderly, female cadaver. Colles' fracture and fracture at middle of ulna produced by blow on palm and anterior dislocation of head of radius caused by simple hyperextension and supination.

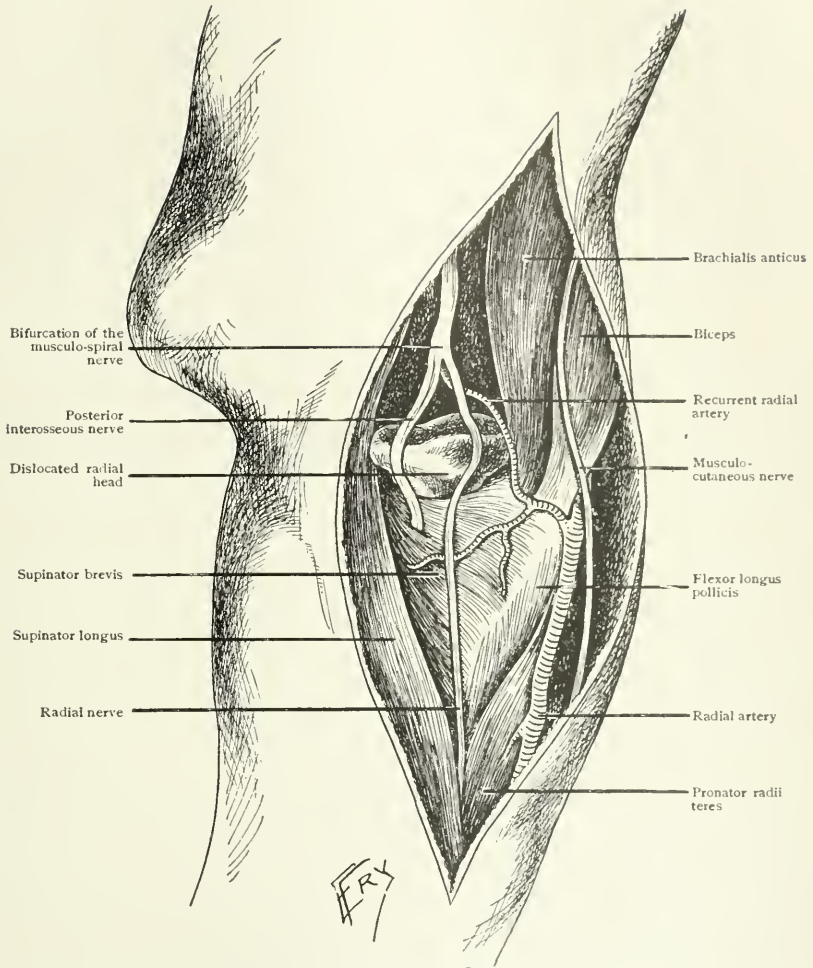
*Dissection.*—Separating the supinator longus one sees the two branches of the musculo-spiral lying to the outer side of the head. The radial is in direct contact with the bone. There is a fracture of the radial head. If the dislocation be made a trifle more outward both branches are caught on the head and are stretched by exaggerating the dislocation. An attempt to rupture nerve by hyperextension is unsuccessful owing to the fact that the upper part of the nerve is not fixed. Even exposure of the trunk of the musculo-spiral in the upper arm and holding this, does not permit of rupturing. The nerve slips through the fingers. It is very tough and elastic, due probably to injecting fluids that have been used to preserve the body.

EXPERIMENT IV.—Right arm of same cadaver, also disarticulated from

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\* Most of these experiments were performed at the anatomical laboratory of Cornell University through the courtesy of Dr. I. S. Haynes.

FIG. 10.



Sketch of condition found in Experiment IV. A similar state of affairs was found in Experiment II. This is a typical relation of the two divisions of the musculo-spiral nerve to the forward dislocated head of the radius.



shoulder. Compound fracture through base of olecranon, with forward and slightly outward dislocation of the head of the radius produced by blow of heavy mallet.

*Dissection.*—Shows the two branches of the nerve slightly stretched over the head of the radius as in Experiment II. The tension is increased by further extending the forearm and relaxed by flexion. (See Fig. 10).

EXPERIMENT V.—February 7, 1908. Cornell University. Right arm, fair-sized, elderly male cadaver. Fracture of ulna above styloid process and later at lower third. Hyperextension produced typical backward dislocation of both bones of the elbow, but incomplete.

*Dissection.*—Retracting the supinator longus, one sees both branches of the musculo-spiral relaxed and some distance away from the bone. This is particularly true of the radial, which could not possibly be injured in this dislocation. The posterior interosseous might be caught if the dislocation were more outward, but it is difficult to conceive how a simple backward dislocation could injure the nerve which simply relaxes and slips from the neck of the bone. In extreme dislocations backward it is possible that it might be stretched.

EXPERIMENT VI.—February 25, 1908. Cornell University. Left arm of cadaver used in previous experiment. Forward dislocation of the head of the radius, produced by hyperextension of the forearm after base of olecranon had been fractured by sharp blow of mallet.

*Dissection.*—The upper extremity of the radius has lifted up and stretched the radial nerve, while the posterior interosseous has entirely escaped. If the dislocation be reduced and the head of the radius be redislocated slightly more outward, both branches are caught. The nerve slips from the bone in an attempt to rupture by increasing the extent of the dislocation. If the radius after having been dislocated forwards, be pushed upwards about 2 cm., the main trunk of the musculo-spiral is impinged upon by the head of the bone.

Before drawing any further inferences from the above experiments, I shall now briefly discuss the

#### SURGICAL ANATOMY OF THE MUSCULO-SPIRAL NERVE AT THE ELBOW JOINT.

Piercing from behind forwards the lateral intermuscular septum above the lateral condyle, the musculo-spiral nerve quits its groove on the humerus, and descending between the brachialis anticus and supinator longus muscles it divides into two branches, the radial and posterior interosseous nerves, just above and in front of the eminentia capitata of the lateral condyle. Just above the point of division are given off mus-

cular branches to the supinator longus, extensor carpi radialis longior and usually to the outer part of the brachialis anticus.

The radial nerve or superficial branch is slightly smaller, is situated medially, and is a purely sensory nerve. It passes over the humero-radial joint and then down along the radial side of the front of the forearm. It is covered by the supinator longus and is gradually approached on its medial side by the radial artery which meets it at about the middle of the forearm.

The posterior interosseous nerve or deep branch is the larger of the two divisions, lies external and posterior to the radial and is in the main a motor nerve. It passes over the humero-radial joint obliquely outward and downward, and just below the head of the radius it pierces the supinator brevis which presents a C-shaped opening for its reception. It passes between the two layers of this muscle, winds in a half spiral turn laterally around the upper part of the shaft of the radius and emerges posteriorly 6-8 cm. below the external epicondyle, lying between the extensor communis and the extensors of the thumb.

The point of division of the musculo-spiral and the two branches for several centimeters below it are then in direct relation to the humero-radial joint, only separated from the bone by the anterior and orbicular ligaments. The nerves are comparatively fixed in their position, and very slightly movable, hence liable to injury. The nerves are held in place in the fascia of the supinator longus, which, if lifted up, takes the nerves with it.

The superficial branch or radial supplies the integument of the radial side of the ball of the thumb, the greater part of the dorsum of the hand, the thumb, index, middle and radial half of the ring finger. It anastomoses with the musculo-cutaneous and ulnar nerves.

The deep branch or posterior interosseous supplies the following muscles,—extensor carpi radialis brevior, supinator brevis, extensor communis digitorum, extensor minimi digiti, extensores pollicis (longus et brevis), extensor indicis and ex-

tensor ossis metacarpi pollicis. A sensory terminal branch is distributed to the wrist joint.

#### CLINICAL SUMMARY.

*Pathogenesis and Pathology.*—In view of the anatomical conditions it is easily understood that in nearly every dislocation of the head of the radius the integrity of the two branches of the musculo-spiral is threatened. This is especially true of anterior dislocations. In this type, the upper extremity of the bone is likely to directly impinge upon the two branches of the nerve, and this occurs almost invariably just below the bifurcation. As a result of the analysis of the reported cases and the experimental investigations I believe we are justified in assuming that :—

*a.* In forward and slightly outward dislocation one or both branches are most likely to be caught. Five out of nine of the cases with ulnar fracture demonstrated this.

*b.* In forward and inward dislocation, the nerves usually escape involvement.

*c.* In forward dislocation, the radial alone may be injured while the posterior interosseous may escape.

*d.* In outward dislocation the posterior interosseous alone may be involved and the radial may be free.

*e.* In backward dislocation, neither nerve is liable to be injured. It is almost out of the question that the sensory branch be affected in this type, but in extreme cases the deep branch might be stretched.

*f.* In forward dislocations where there is a marked displacement upwards the head of the bone might strike the main trunk of the nerve.

When the dislocation is a complication of fracture of the ulna, the nerve is much more likely to be affected, as the displacement of the radius is usually much greater under these conditions. While the literature of simple dislocation has not been reviewed by me as exhaustively as that of the combined fracture and dislocation, I have examined the large majority of the special papers on the former subject and have found

but one case of nerve injury, while in the latter class I have found nine instances. Although there is great probability that even in simple dislocations the nerve injury is more frequent than the one case found would indicate, the proportion of one to nine is significant.

As to the exact nature of the nerve injury, this is usually a direct contusion by the protruding bone or an actual laceration, complete or partial, followed by the usual degenerative changes. In the operated cases, the nerves were never found completely torn across,—though in my case the nerve fibres seemed completely divided and the nerve ends were held together merely by fibrous strands, the remains of the sheaths.

The nerves are usually stretched directly over the radial head, and hyperextension, which exaggerates the dislocation, tends to increase the tension of the nerve, and likewise the injury. One or both nerves may be pushed medially or laterally, or the head may emerge between the two branches producing an injury in this position.

It is conceivable that under certain conditions the nerves might simply be stretched without coming in contact with the bones, and thus sustain, from the pull, a partial or complete rupture. This would be the mechanism in posterior interosseous paralysis due to posterior dislocations. The nerve injury usually takes place directly at the time of the joint lesion.

The frequency of this nerve complication is comparatively great as statistics of its incidence in cases of the double bone and joint lesion indicate. In the one hundred and nineteen cases of fracture of the ulna associated with dislocation of the upper extremity of the radius, which I have succeeded in collecting from the literature, the nerve was injured in nine cases, or 7.56 per cent.

*Symptomatology and Diagnosis.*—The symptoms are very much the same as the classical ones of musculo-spiral palsy added to the usual ones of fracture and dislocation or dislocation alone. They may be complete or incomplete in their distribution or their degree, depending upon whether one or both

branches are involved and to what extent. As the main trunk of the nerve appears never to be injured, except in decided upward displacements, there may be only sensory or only motor symptoms, if only the radial or only the posterior interosseous be caught—or if both branches are damaged the symptoms will be mixed. Of the ten reported cases four were mixed, three were purely motor and one was apparently a purely sensory paralysis. In two the nature of the paralysis was not specified.

The usual anaesthesias in the area of the radial distribution, the extensor paralysis, and the trophic disturbances are too well known to detail here. These are regularly present and are partial or complete according to whether the nerve conduction be completely or only partially destroyed.

One characteristic and significant fact is that the supinator longus is not likely to be paralyzed, as its branch is given off just above the bifurcation.

The nerve symptoms usually develop promptly after the injury. The diagnosis of the lesion is self-evident.

*Prognosis and Treatment.*—The prognosis of this form of musculo-spiral paralysis is good, notwithstanding Doerfler's opinion to the contrary. In only two of the ten cases is it definitely stated that the paralysis was permanent. Six were positively cured, and in two the final result is not indicated. The ultimate restoration of function is of course best if the correct treatment be applied as soon after the injury as possible.

Treatment consists primarily in freeing the injured nerve and this, fortunately, generally corresponds to the regular treatment for the dislocation itself.

1. If possible, *i.e.*, if the injury is recent, a bloodless reduction might be attempted. This can be accomplished by extension, traction, and then flexion. Pressure on the head of the radius advocated by some authors should be avoided for fear of further damaging the nerve—as also hyperextension. After reduction, the arm can be put in plaster, in semi-flexion midway between pronation and supination. The ulnar frac-

ture simply requires the usual reduction of the deformity and anterior and posterior splints or a plaster dressing.

2. If the attempt at simple reduction is not successful and the ulna fragments are still ununited, an arthrotomy with reduction of the radial head and suture of the capsule tear, as advocated by Sprengel<sup>12</sup> in isolated dislocation, might be tried. However, this procedure will only be of service in very specially selected cases in which there has been no too great disturbance of the adjacent tissues. Further, if the articular surfaces have been destroyed, if the head is hypertrophied, and especially if the ulna fragments have united with shortening of the bone, arthrotomy is of little use.

Osteoclasia of the ulna, proposed by Doerfler, may be of service if the deformity of this bone is very great, but simply to lengthen the ulna in order to render arthrotomy possible, does not justify refracture.

3. Resection of the head of the radius, first suggested by Loebker<sup>13</sup> and later advocated by numerous other surgeons in old dislocations of the head of the radius, is unquestionably the operation of choice in the majority of older cases, where reduction is not possible by the bloodless method. This accomplishes the double purpose of relieving the nerve and of restoring the impaired elbow function in the simplest manner possible. The lateral incision of Hueter<sup>14</sup> should be used to avoid further damage to the nerve, and the most practical way of removing the head is with a Gigli saw. Four of the ten cases collected were cured by resection.

4. Suture of the nerve by one of the approved methods must of course be performed should it be found ruptured at the time of operation. Yet, if the remains of the nerve sheath hold the ends of the torn nerve together, it is scarcely necessary to sew the nerve, as my case demonstrates. If, after simple reduction there be no improvement within three months, the nerves must be exposed, as rupture or scars are probably responsible for the non-improvement and must be treated.

5. Electricity, massage, active and passive motion, and

stimulating medication should be used as adjuvants of the surgical treatment.

6. Prophylactically the following might be emphasized: In all cases of dislocation of the head of the radius in which the nerve is not involved, the fact that the nerve is in close relation to the dislocated head must be borne in mind and care must be exercised not to produce a nerve lesion by rough or careless manipulation, particularly in the sense of hyperextension or direct digital pressure on the head of the bone. The known proximity of the nerve to the radial head should in itself constitute a definite indication for reduction, for even if there is no primary paralysis a pressure paralysis may develop secondarily, if the dislocation remain unreduced. One should likewise avoid applying a tight bandage before the dislocation has been reduced, as the nerve might easily be compressed against the bone. Further, in all operations on the dislocated radial head the position of the nerve must be remembered, so that it is not injured by careless operative technique.

#### CONCLUSIONS.

1. Musculo-spiral paralysis as a result of dislocation of the head of the radius is a distinct type of nerve injury, and is quite as definite and characteristic as any other form of injury to this nerve. In fact, in every case of anterior dislocation of the head of the radius the two divisions of the musculospiral nerve are in danger and it is a fortunate accident if they escape.

2. Its actual occurrence is naturally rare, but comparatively, *i.e.*, compared to the frequency of the joint injury itself, it is not infrequent.

3. It is most likely to occur when the dislocation accompanies ulnar fracture and when the direction of the dislocation is forward and slightly outward.

4. The nerve is almost invariably injured below its point of division into the posterior interosseous and radial. One or both branches may be caught by the dislocated head.

5. The symptoms are practically those of the typical

musculo-spiral palsy. They may vary greatly in extent or degree, depending upon whether one or both nerves be injured and how badly. The supinator longus muscle escapes involvement.

6. The prognosis is good under appropriate treatment, which is practically the same as that for the dislocation: simple reduction, if possible, and generally resection of the head of the radius in old cases, with nerve suture if necessary.

7. Should the nerve be uninjured in a dislocation of the radial head, its close proximity to the bone should be borne in mind, the dislocation should be reduced, and care should be exercised not to injure the nerve, by pressure, hyperextension or careless operative technique.

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## ADDENDA.

After this paper was finished, a publication by Sherren<sup>1</sup> appeared on injuries of nerves to which I refer here for the sake of completeness. He states that he has seen one case of musculo-spiral paralysis due to forward dislocation of the head of the radius and that Borchard has also observed the condition once. I have searched for the latter's report in vain. Sherren gives no particulars of the two cases, not even mentioning whether or not there existed a fracture of the ulna. He simply made the general statement that posterior interosseous paralysis, especially, may be a complication of dislocation and fracture of the upper extremity of the radius.

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<sup>1</sup> Sherren, J. *Injuries of Nerves and Their Treatment*, London, 1908, p. 233.

## CONGENITAL DEFECT IN THE ULNA.\*

BY FRANCIS DENISON PATTERSON, M.D.,

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THE condition of congenital absence of the ulna is one of the rarest anomalies to which the skeleton is liable. My patient also presented the extremely interesting feature of there being associated with it a true hyperplasia of bone in other portions of the body. A few of the numerous exostoses, from which she also suffered, are clearly shown in the accompanying X-ray photographs.

She first presented herself to me for treatment about two years ago, at the dispensary of the Howard Hospital, for what she believed was a dislocation of the right wrist, as the result of a traumatism and at that time I elicited the following history: M. D., aged 16 years, white, and by occupation an actress.

*Family History.*—Father living and well. Mother living but bed-ridden with "dropsy"; three brothers and three sisters living and well; four brothers and three sisters dead, two of diphtheria, one of meningitis and the others in infancy. Has no knowledge of any tuberculosis, malignant disease or syphilis in the family. No other member, immediate nor remote, of her family has suffered from any deformities.

*Previous History.*—Had diphtheria, scarlet fever, measles, chicken pox and typhoid fever two years ago, from all of which diseases she made a good recovery. Six months ago she noticed that exostoses were appearing, especially about the knees and ankles and the arms. Since that time they have steadily increased in size, and give constant pain which is increased by motion and pressure. She states that a "lump" appears whenever she receives a traumatism.

*History of Present Condition.*—Was playing with her sister who caught her by the right hand and gave it a violent pull,

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\* Read before the Philadelphia County Medical Society, February 26, 1908.

FIG. 1.



Absence of lower end of right ulna.

FIG. 2



Left forearm.  
Multiple exostoses.

Right forearm.

which was at once followed by a marked deformity and complete loss of motion of the wrist joint. An attempt was made to make an examination without an anesthetic but the patient was very hysterical, so ether was given and the wrist joint was found not only freely movable in all directions, but the absence of the lower end of the ulna could be clearly felt. Further examination showed the presence of numerous exostoses. They are very marked on the upper end of the right humerus and on the left radius. The right wrist was dressed with a solution of lead water and alcohol and then put at rest upon a splint. X-ray photographs (see Fig. 1) were taken later that day and they show not only the absence of a portion of the ulna but also the exostoses on some of the other bones. Under rest the inflammation rapidly disappeared from the wrist joint and the patient soon had as good use of this arm as she had prior to the accident. I urged operation upon the exostoses, but the patient declined it, and I lost sight of her until she was admitted a year later to the Philadelphia Hospital, in the service of Dr. J. Chalmers Da Costa, and on June 13, 1906, his assistant Dr. Schwartz removed a number of the exostoses from the upper part of the tibia on both sides and from the external condyle of the femur on the right side. These were found to be very hard and attached firmly to the shaft of the bones. The patient made an uninterrupted recovery, and was eventually discharged from the hospital proper to the "Out Wards." She was readmitted to the surgical ward of the hospital in March, 1907, and on the 19th of that month she had the exostoses removed from the lower limbs. Two from the right knee, one from the outside and one from the inside. One from the outside of the left knee, the only one which was not firmly adherent to the femur. One also was removed from the lower end of the right fibula. The patient again made a good recovery and returned to the out wards. She has been there ever since except when admitted to the hospital, once for a gynecological operation and again for operation for appendicitis, both of which were successful.

Congenital absence of the ulna is a very rare condition; after a careful search of the literature I have been able to find but eight other reported cases. Förster, in his classical monograph, "*Missbildungen d. Menschen*," does not even mention

this anomaly, although he notes the frequent absence of the radius. The cases that have been previously reported are briefly the following:

1. GOLLER (quoted by A. Schnelle, "Inaugural Dissertation," Göttingen, 1875), in 1698, described a seven months' old foetus, in which both ulna with four fingers were absent, only the radii and both thumbs being present, and in the lower extremities only the tibia and great toes were present.

2. SENFTLEBEN (Virchow's Archiv., xlv, 1869, p. 303) notes the case of a recruit, aged 21 years, in whose left ulna there was a defect occupying the middle third of the bone. This defect measured two and one-half inches, and where the bone was absent a ligamentous band could be felt. The patient was in every other way normal.

3. ROBERTS (Trans. Path. Soc., Philadelphia, xiii, 1885, p. 4) reports the case of a man, 73 years old, whose right ulna was absent along with the third, fourth and fifth digits and their metacarpal bones. The pisiform, cuneiform and unciform bones were absent from the wrist. On the left side the ulna was present, but the third and fourth digits and the third metacarpal bone were wanting. The patient stated that his sister had one hand deformed like his and that she was the mother of a perfectly formed child. Another sister's child had a hand deformed like his right hand. The patient further stated that he had seven children, of whom three had malformations similar to his.

4. PRINGLE (Jour. of Anat. and Physiol., xxviii, 1893, p. 239) states that he had under observation, a man, aged 31 years, in whom both ulna were absent. There was no family history of deformities. The mother stated that the patient was born at full term, but during the early months of pregnancy she had received a severe fright. Right arm: The hand is provided with three fingers only, one well developed, which appears to be the middle finger, and two malformed ones, one to each side of the former. The wrist joint is freely movable, the trapezium is absent, but it is not possible to determine if any other carpal bones are wanting. There is no trace of the ulna. Left arm: The hand is narrower and less well shaped than the right; it also is provided with only three digits, the best developed of which seems to be the index. The wrist joint is freely movable, and the left trapezium is present. There is no trace of the ulna.

5. LANE (Trans. Clin. Soc., London, xxxii, 1898-9, p. 44) reports the case of a girl, 3 years of age, whose ulna consisted of two separate parts, whose pointed extremities slightly overlapped and whose axes varied considerably in direction. The lower end of the ulna was situated considerably above the level of the extremity of the radius. No evidence of any other deformity. It is interesting to note that this deformity was successfully corrected by the wiring in of the femur of a rabbit.

6. YUNT (Vrach. Gaz., S. Peterb., x, 1903, p. 342) notes the case of a woman, aged 62 years, who presented herself for treatment for a

fracture of the neck of the left humerus and in whom the right ulna was almost entirely absent. It consisted of a piece of bone, 7.5 c.m. long, extending downward from the elbow. The radius was arch-like in shape and somewhat thickened below where it articulated with the carpus; its upper extremity was dislocated forward and outward. The right hand was smaller than the left but all its bones were present. The only other deformity was an absence of the right pronator quadratus muscle. All the normal movements of the fore arm were well preserved except flexion of the elbow, which was much limited for purely mechanical reasons.

7. KACKKACHEFF (Russk. Gaz. S. Peterb., iii, 1904, p. 325) reports the case of a man, 24 years of age, in whom the left ulna was entirely absent. Pronation was well preserved. There was no other deformity.

8. AGAYEFF (Vrach. Gaz. S. Peterb., xii, 1905, p. 155) notes the case of a man, 40 years, who gave a history of polydactylism in his mother, who had it in one of her feet, and in an uncle, on his father's side, who had it in both feet. The patient had had four children and all were perfectly formed. Right arm: The only deformity was polydactylism of the little finger. Left arm: This arm was flexed at the elbow and in incomplete pronation. The hand had but three fingers, the thumb, index and middle. A rudiment of the little finger was also present. The humerus was normal and in the trochlear region was a round bony prominence, of the shape of the patella, movable in all directions and attached to the tendon of the triceps muscle. The ulna was completely absent, except for this rudiment. The little finger and the fourth and fifth metacarpal bones were absent, as was also the unciform and os magnum. The movements of this hand were somewhat limited, chiefly for mechanical reasons. No evidence of any other deformity.

The literature of multiple exostoses is indeed a voluminous one. I have gone through it with care and been able to find only one case where the hyperplasia of bone was associated with a congenital osseous defect. Battle (Trans. Clin. Soc., London, xxxix, 1905-6, p. 252) reports the case of a girl, 13 years of age, who had osteomata on nearly all the long bones, near their terminal epiphyses. The right ulna measured only six and one-half inches, while the left measured nine inches. The bone was well formed, only it was shorter than the radius, which had its shaft bowed outward and the head of the bone was displaced forward and outward.

## THE SURGICAL TREATMENT OF BUNION.

BY CHARLES H. MAYO, M.D.,

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THE discomfort suffered by patients afflicted with bunions is so far in excess of the apparent simplicity of the malady that the disease has come to be a subject well worthy of consideration from a surgical point of view. The condition is usually associated with hallux valgus and is attributed to various causes; the principal one being the wearing of pointed, short and tight shoes. Arthritis and gout may be contributing factors in some cases. From the examination of many patients with this trouble, it appears that the peculiar shape of some feet renders them liable to this deformity. The primitive foot was probably used for grasping objects, the great toe being situated farther back, somewhat like, but less marked than the thumb on the hand, and as is now seen in some of the lower animals.

Confinement of the foot incident to civilization, has possibly tended to the advanced position of the great toe, though many feet still present the short great toe with the wide foot in which the second and often the middle toe is the longer. Such feet rarely have the deformity "hallux valgus," although some slight bunion may be present, and this regardless of the kind of shoe worn.

The characteristic of the foot with tendency to bunion is, that the great toe when straight is from one-fourth to one-half inch longer than the second toe. This type of foot may remain a perfect foot through life but should it become confined in a pointed-toe, narrow, and especially a short shoe, the leverage action against the inner side of the great toe develops hallux valgus with true bony growth on the inner side of the head of the metatarsal bone which becomes covered by a bursal layer. This area becomes most painful to pressure and is liable to special attacks of inflammation. The tendon of the

FIG. 1.



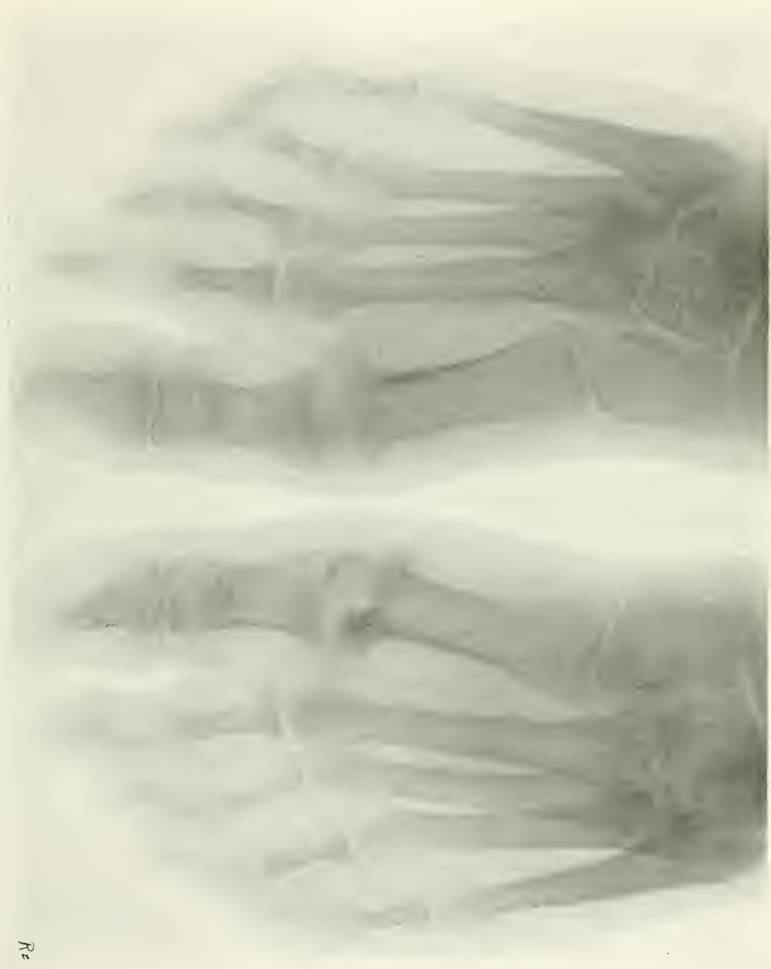
Hallux valgus deformity as shown by photograph.

FIG. 2.



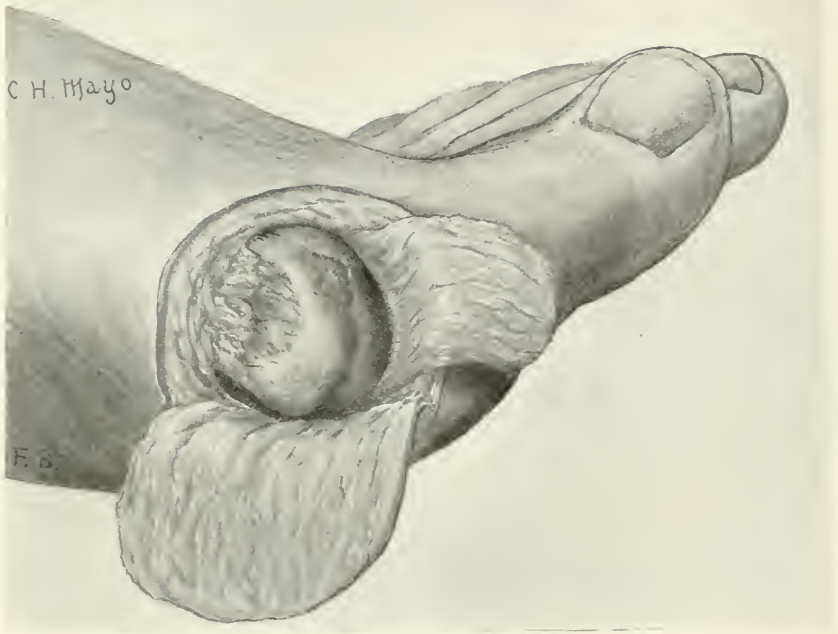
Deformity as shown by radiograph

Fig. 3.



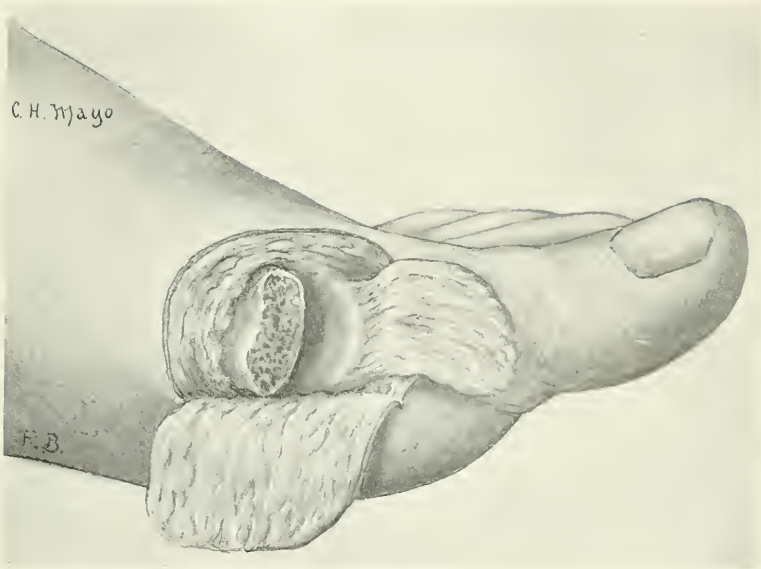
Radiograph of result after nine months

FIG. 4.



Showing bony deformity

FIG. 5.



Bone section ready for insertion of bursa.

FIG 6



Suturing of bursa to develop joint.

extensor proprius pollicis becomes displaced to the outer side of the joint area, and with the angulation of the toe its sheath becomes a pulley which soon gives way to tension, after which the tendon acts to still further increase the deformity.

Many patients have the trouble in so slight a degree that proper shoe-fitting will relieve them. Some secure comfort by wearing special appliances for supporting the toe or protecting the bunion.

Several operations are recommended for the cure of hallux valgus. Resection of the metatarsophalangeal joint is often practiced; also a wedge-shaped or simple osteotomy of the metatarsal bone, which will relieve some cases but does not narrow the foot or remove the bunion, if it is present.

It is also recommended by some operators, to remove the head of the metatarsal, and, to avoid the scar about the inner side of the joint, their incision is made between the first and second toes.

For a number of years we have practiced the following method in operating upon patients afflicted with this trouble and the regularity of its success leads us to present the technic of the method.

*Operation.*—A curved incision is made base down over the inner side of the metatarsophalangeal joint, the skin being lifted in the flap which is separated from the bursa. A curved incision "horse-shoe" is now made around the bursa with its base forward left attached to the base of the first phalanx, its inner surface being synovial membrane and continuous with the anterior surface of the joint.

The head of the metatarsal bone is then removed with heavy forceps, the section also removing two-thirds of the anterior portion of the bony hypertrophy on the inner side. The remainder of this projecting bone is cut away to the level of the shaft of the metatarsal. The cut end of the metatarsal bone is now rendered as smooth as possible by rongeur forceps and the bursal flap turned in to the joint area in front of the bone, where it is held in place by one or two catgut sutures. We thus utilize an already formed bursa to secure and main-

tain a movable joint which works in a movable splint,—the shoe,—and thereby secure an immediate result, which is obtained with difficulty in other joints by transplanting fatty tissue into the joint area to prevent bony union; an operation made familiar by the efforts of Dr. J. B. Murphy, who has demonstrated its great value in certain cases where the joints have become fixed by injury, disease, or operation. But in these cases, there being no natural fixed support like the shoe, it is necessary to use apparatus to limit and direct the motion. In some cases the tendon and sheath of the extensor proprius pollicis is best displaced by suture to the inner side of the mid-line of the toe.

Provision is made for drainage by a punctured incision in the base of the skin flap in which is inserted a doubled catgut strand. The skin incision is now sutured in place with horse-hair or catgut. The dressing is a pad of gauze wet in 70 per cent. alcohol, placed between the great and second toes. The anterior portion of the foot is covered with a dressing which is moistened with the same solution at intervals during the first few days.

With ordinary care in protecting the wound these patients are often much better able to go about within two weeks than they were before the operation. It frequently occurs that they are not even kept in the hospital during convalescence.

The motion becomes nearly perfect. The great toe is shortened to a reasonable degree, somewhat narrowing the foot at its widest line; a factor of importance in the prevention of recurrence. The bearing surface for support is excellent as the under side of the joint floor is not disturbed, and the cushion beneath with its sesamoid bones is left intact.

Theoretically it could be said, that the scar is badly placed and would be subject to pressure from the shoe. Practically this is not true, as we have found from operating upon 65 cases during the past eight years according to this method.



FIG. 1.



Motor held in hand ready to operate.

## A NEW MOTOR FOR BONE SURGERY.\*

BY W. SOHIER BRYANT, M.D.,

OF NEW YORK.

DESCRIPTION of motor:  $3/10$  horse-power; 3 phrase; 10 volts; 15,000 revolutions per minute; 185 cycles; 2 poles; diameter,  $2\frac{1}{8}$  inches; length of barrel,  $9\frac{1}{2}$  inches; weight, 7 lbs. 5 ozs.

This motor is unique in as much as it is the first practical application of well known electrical principles in such a way as to combine three-tenths horse-power with a weight of only seven pounds, about one-eighth that of the ordinary motor of equal power. Because of its light weight it fills the requirements better than any other motor for use in the flying machine where weight is the chief difficulty to be overcome. The great advantage in thus reducing the size and weight of the motor is that it can readily be held in the hand and is able in this way to solve the problem of shafting or gearing by doing away with both.

In point of speed this motor is again far in advance of any now on the market, making 15,000 revolutions per minute. Owing to this velocity and power, the instrument is very effective since it eats up the bone with great rapidity and saves much valuable time. On account of the speed of the motor a phrase is used with only one cutting edge which cannot clog. The phrase does not heat as all the heat generated is taken up by the chips. The motor can be used as a drill, as a bur to enlarge a bone cavity, as a phrase to cut an osteoplastic flap, and lastly as a trephine. It will not cut soft tissue. An important surgical point is that this instrument together with its wire connections can be sterilized.

The motor was designed and constructed for Dr. Bryant by the International Instrument Co. of Cambridge, Mass.

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\* Presented before the Section on Surgery of the New York Academy of Medicine, February 7, 1908.

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, March 25, 1908.*

The President, DR. JOSEPH A. BLAKE, in the Chair.

### LARGE LUMBAR HERNIA TREATED BY SILVER FILIGREE.

DR. FORBES HAWKES presented a man, 44 years old, who after a nephrectomy done eight years ago, had developed a large lumbar hernia. This had been reduced and a silver wire filigree netting inserted. As the result of a fall this filigree was broken and six months later small pieces of the wire began to extrude; it was finally necessary to remove it entirely. A more flexible silver wire filigree netting was then inserted, and this had now been worn by the patient for over two years with perfect comfort. It seemed probable that one of its strands also had become separated.

DR. WILLY MEYER said he had often resorted to the use of silver wire filigree in dealing with large hernial protrusions with entire success. In his first case, which was operated on in 1901, as well as in many subsequent cases, the filigree had remained in place and was very satisfactory. The method should be limited to those cases with large hernial apertures that could not be otherwise closed.

Dr. Meyer said that in one case where he employed this expedient the wall of a coil of small intestine was accidentally caught in stitching the filigree into place, and the gut finally perforated and a fecal fistula formed. This is the only one in his series in which the filigree had to be removed later. In every other one it staid in place. He feels convinced that the silver wire filigree, whether implanted ready-made or arranged during the operation, will always stay in place and guard against a recurrence of the hernia, if aseptic healing takes place. In case of suppuration, Bier's hyperæmic treatment with the help of cupping

glasses should be given a thorough trial before resorting to the removal of the wire netting.

## PAPILLOMATA OF THE BLADDER.

DR. JOHN F. ERDMANN presented a man, 29 years old, who came under his care on November 27, 1906. Eighteen months before, he had noticed, while urinating, that he was passing blood. At certain times it would be almost pure blood; then there were evidences of intermittent bleeding, sometimes just enough to stain the urine, sometimes profound discoloration with clots. There would occasionally be a spasm upon urinating, before the bladder was empty. In the past two months there had been no visible evidence of blood until one week ago, when there was again free hæmaturia. Bloody urine would be induced by jumping on and off cars. He has never had any pain referable to kidney, perineum, bladder or urethra; no thigh nor leg pains. Health otherwise is absolutely perfect. Once he had slight pain in his groin; occasionally has had pain in the lower right side. Never has had any specific disease. He says that the first voiding of blood occurred subsequent to taking a bottle of citrate of magnesia, which was followed by violent catharsis. Urine analysis negative as to kidney cells, casts, etc. He has never had any putrid urine, nor been examined by cystoscope or searchers. No loss of flesh. Voids ample quantity of urine. Cystoscopy showed papilloma of very large size, apparently arising from the right side.

Suprapubic operation was done on Thanksgiving Day, 1906. Upon exposing the interior of the bladder it was found that the papilloma arose from a base of one and a half inches in length, and a quarter inch in width, just above and to the right of the right ureteral orifice. The papilloma itself was one that practically filled the entire bladder, and upon extraction readily filled the hand. Removal was made by means of excision and suture of the gap in the mucosa and submucosa. The patient made a recovery in a period of three to four weeks.

DR. ERDMANN presented a second case, a man 40 years old, who first visited him in September, 1907, and gave a history of occasional bleeding. The urine varied from a slight evidence, by microscope, to very profound evidence of fresh and disintegrated blood. There were no evidences of pain at any time in his history, his attention being called to the trouble by seeing the dis-

coloration of the urine. Cystoscopy showed a papilloma about the size of a filbert near the right ureteral orifice, pedunculated. This was removed on September 23, 1907, and barring a phlebitis, both pelvic and saphenous, his convalescence was without further note, the wound in the bladder having healed in fourteen to sixteen days. The method of removal was suprapubic, grasping the pedicle in the forceps and excision through the mucosa and submucosa, with final suture.

#### PERINEAL PROSTATECTOMY.

DR. CHARLES H. PECK presented a man, 64 years old, who was in good health up to about two years prior to his operation. Since that time he had suffered with increasing frequency of micturition, with tenesmus and a feeling that the bladder had been incompletely emptied. He has been obliged to get up many times at night for months past. One week before operation acute retention developed for the first time. His bladder reached above the umbilicus when first seen by his physician, and about three quarts of urine were withdrawn at one time. When first examined by Dr. Peck on April 10, 1907, the summit of the bladder was above the umbilicus, and more than two quarts of urine were withdrawn by a catheter, which passed easily. Examination by rectum showed marked enlargement of both lateral lobes of the prostate, the upper margin of which could not be reached with the finger. For 24 hours on the 11th and 12th of April sixty ounces of urine were drawn every four hours for nearly the entire day (24 hours), the total being 348 ounces. Patient drank enormous quantities of water. Urine showed a very faint trace of albumin, no sugar, a very few hyaline casts; specific gravity, 1.009; urea, 0.8 per cent. ( $74\frac{1}{2}$  grams in 24 hours); leucocytes were 14,100, polynuclear cells, 85 per cent.; hæmoglobin, 85 per cent.; red cells, 5,000,000. Patient was extremely stout weighing about 240 pounds; he was slightly cyanotic; no cardiac murmurs; pulse of increased tension, fair quality.

Operation was performed April 13, 1907, under chloroform anæsthesia. A median perineal incision was made, and a Young's tractor passed into the bladder. The rectum was separated from the prostate by blunt dissection, and division of median bands of tissue with scissors. An incision was made through the capsule over the lateral lobe on each side, and six or eight separate

nodules varying in size from a pea to a pecan nut were shelled out with the ungloved finger. Palpation with the finger in each lateral cavity against the retractor in the bladder, and then with the finger in the rectum, demonstrated that the capsule was practically empty; there was no median enlargement. The tractor was then removed and the finger passed through the prostatic urethra to the bladder; there was no obstruction and no stone. A 31 F. sound was passed through the urethra to the bladder and a large perineal drainage-tube inserted and secured. Time of operation, 55 minutes.

The kidneys acted freely after the operation, 240 ounces being passed in 24 hours. The tube was removed and a sound passed on the sixth day. Some elevation of temperature followed, and the tube was replaced four days later and left two days more. On May 7th urine began to pass through the urethra; residual urine about 20 ounces. On May 12th, one month after operation, residual urine was 6 to 8 ounces, and the patient was able to hold his urine from 4 to 6 hours. Sounds were passed every 4 or 5 days. Patient left hospital for his home on May 19th, about 5 weeks after his operation. The perineal wound was nearly closed, but a little urine still escaped. One month later he developed a suppurative phlebitis of right leg, which required incision and drainage, and kept him in bed for some weeks. He now has perfect urinary control; there is still a little moisture at the perineal fistula, but only a drop or two of urine escapes at urination. He is able to retain urine 2 to 4 hours, passing he thinks as much as three-quarters of a pint each time.

The case presented some unusual difficulties; *e.g.*, the great obesity, with poor circulation, and a tendency to cyanosis, increasing the immediate operative and anæsthetic risk; and the high grade of polyuria, which, together with the onset of complete retention, made continuous catheterization impracticable, and operation imperative.

#### CARCINOMA OF RECTUM TEN YEARS AFTER EXTIRPATION OF ADENOMA OF HEPATIC FLEXURE.

DR. HOWARD LILIENTHAL presented a man of 50 years who was operated on ten years ago for the removal of a tumor of the hepatic flexure which involved the entire ascending colon, part of the transverse colon and six inches of ileum. A resection was

done, and the ileum was anastomosed to the end of the colon by means of a Murphy button. The necessity for the removal of such a large segment of gut was that the ascending cæcum and colon had been drawn up and had become adherent to the adenomatous growth. The patient made an excellent recovery, in spite of his poor general condition at the time of the operation. The excised growth was carefully examined, and proved to be an adenoma.

The patient remained in good health until about one year ago, when he began to complain of pain in the rectum, which was worse on defecation. His stools contained pus and some blood, and there was considerable loss of flesh and strength. Upon examination, Dr. Lilienthal found what he immediately took to be a carcinoma of the anal portion of the rectum, constricting it considerably, and with a number of fissures. A section of the growth removed for microscopic purposes showed adenocarcinoma.

Operation, December 25, 1907. Upon section, the growth was found to extend so high up that it would be impossible to resort to Gersuny's method of twisting the bowel to form a new sphincter after removal of the tumor. The coccyx was removed, and a clamp applied to the rectum about an inch above the tumor; the latter was then pulled down and sewn to the skin, leaving a good-sized opening for drainage. Twelve hours later it was noted that the patient had not passed any urine, and attempts to pass a catheter had failed. This was attributed to accidental injury of the urethra in the course of the operation on the rectum, and before a catheter could be introduced *per urethram* it was found necessary to make a perineal opening pass a catheter from the suprapubic wound through the perineal wound, and insert a sound from the meatus down to the perineal wound. A catheter was then introduced into the bladder through the urethra and left in for ten days. By that time granulations had formed, and the catheter was passed at increasing intervals, and now the patient had no further trouble in passing his urine.

In connection with the rectal operation, Dr. Lilienthal said that in spite of the fact that the ascending colon, part of the transverse colon, and all of his rectum was removed, the patient was still able to hold his stools, although no effort had been made to form a sphincter. By carefully dieting himself and by the

use of subgallate of bismuth, he was able to control his bowels, and had but one passage a day.

#### CRANIOTOMY FOR TUMOR OF ACOUSTIC NERVE.

DR. WILLY MEYER presented a woman, 23 years old, who was referred to Dr. Meyer by Dr. George W. Jacoby. She had a slight facial palsy on the left side, with drooping of the left eyelid and the corresponding angle of the mouth. She complained chiefly of dizziness and staggering while walking, and swayed on standing. Hearing on the left side was much impaired. There was slight headache; rarely vomiting; choked discs with atrophy.

After careful observation, the case was regarded as one of tumor of the pontocerebellar angle, involving the left auditory and facial nerve, and an operation for its removal was undertaken on January 29, 1908. Preliminary to the operation, the head of the table was elevated, so that the body rested in the inverted Trendelenburg position, with the forehead resting on a special attachment, and hands and feet being supported. Following the suggestion of Dr. Dawbarn, blood was stored in both lower extremities for emergency purposes. Anæsthesia was effected by introducing two long tubes through the nostrils, and administering the anæsthetic through a funnel, a mixture of ether, chloroform, and ethyl chloride being used. In the course of the operation, additional narcotization became necessary, and this was given by means of a mask, with the anæsthetist sitting underneath the operating table. Anæsthesia was very satisfactory throughout.

The occiput was exposed through a large horseshoe incision, extending from one mastoid to the other, and reaching about two fingers' width above the occipital protuberance. This flap was then divided into two equal parts and retracted, thus giving a free exposure of the cerebellar region. After trephining with chisel the bone was removed with the rongeur forceps down to the foramen occipitale, this work being greatly facilitated by first thinning the bone with a large curved chisel. At various points, severe venous hemorrhage was encountered from the divided bone, but this was readily controlled by the application of Horsley's wax. Both lateral sinuses were fully exposed, and at last the bridge of bone in the median line cut through with Gigli saw and removed. Now the dura mater was opened and cut parallel with the border of the divided bone on either side near to the

median line. Here a double ligature was placed around the longitudinal sinus and the latter divided between. A clamp, placed on the distal end, furnished additional security against hemorrhage. Now the entire surface of the cerebellum would be widely exposed. A pronounced bulging of the cerebellum was noted, palpation of which proved negative. An assistant then introduced an angulated brain spatula between the tentorium cerebelli and the cerebellum itself towards the petrous portion of the temporal bone. This was followed by a furious hemorrhage (arterial and venous), filling the deep funnel again and again, in spite of the use of tamponades and the local application of adrenalin solution. Upon quickly removing the tampon from the cavity, it was seen that the hemorrhage came from the tentorium cerebelli from an artery and vein which evidently connected with the pia mater of the cerebellum; these vessels had been torn in spite of the very gentle introduction of the blunt retractor. The hemorrhage was immediately controlled by compression with the gloved finger; the field of operation was perfectly dry. Further exploration then revealed a tumor, bluish-white in color and about the size of a cherry, near the meatus auditorius internus; it was hard to the touch, and comparatively easily shelled out in three pieces. The surrounding brain tissue was soft to the touch. A tampon was left in place to prevent hemorrhage, and a split rubber tube introduced for drainage. The dura mater flap was replaced, but would cover only the lower half of the cerebellum, on account of the acute œdema of the latter. Injury of the bulging brain by the projecting external occipital protuberance was avoided by gauze tamponade of the latter's roughened border.

Subsequent to the operation there was a good deal of oozing of cerebrospinal fluid and for a few days considerable œdema of the face; otherwise recovery was uninterrupted. Gradual improvement in the patient's eyesight and other symptoms had taken place since the operation, which was done eight weeks ago.

DR. GEORGE WOOLSEY said he had operated three times for the removal of neurofibromata of the acoustic nerve—each time with a fatal result. In the first case the tumor was removed piecemeal, and the patient, although he apparently did well for a time, died of a small hemorrhage which penetrated the pons. In the second case the operation was attempted in two stages, and the patient died after the first stage. In the third case the

operation was also done in two stages. In the second stage, on opening the dura, the cerebellum bulged tremendously, so that it was exceedingly difficult to reach the tumor, which had attained considerable size, being about as large as an English walnut. In all these cases, Dr. Woolsey said, the ease with which the growth could be removed depended a good deal on its size, and his experience had impressed him with the importance of making a good-sized opening in the skull, in order to secure proper access, and to take care of the protrusion of the cerebellum that usually occurred when the dura was opened. He thought that access to these tumors could best be gained by the removal of a considerable part of the lateral lobe of the cerebellum, and this view was also held and practiced by Mr. C. A. Ballance, of London, with whom he had discussed the subject about 2 years ago.

Most of the mechanical contrivances for opening the skull were not very serviceable in operations in this region. If the operation could be done in one stage, that was preferable. The observation of the blood pressure was therefore most important in these cases. The mere relief of intracranial pressure was a most important factor, and that was best accomplished by making a large opening in the skull. This combined with excision of part of the lateral lobe of the cerebellum afforded the best access to the tumor.

DR. GEORGE W. JACOBY said that in view of the frequent occurrence of these tumors, particularly those of the acoustic nerve and of the pontocerebellar angle, cases like that reported by Dr. Willy Meyer were exceedingly instructive, and emphasized the fact that brain surgery was no longer confined, as had been said, to the motor area. In the majority of cases, these tumors involving a special nerve, such as the acoustic, facial or trigeminal, were rather small and easily enucleated. Clinically, we could usually tell whether we were dealing with a primary tumor of the acoustic nerve, or one originating from the pons, medulla or bone. In the case presented by Dr. Meyer there was marked cerebellar gait, with dizziness and almost complete blindness. These symptoms, together with persistent vomiting and headaches, pointed pretty clearly to some growth in the posterior fossa. In addition, there was increasing deafness on one side, with facial paralysis of the peripheral type and the loss of the corneal reflex on the same side indicating involvement of the trigeminal. Upon

these symptoms, the diagnosis of an acoustic nerve tumor was based.

DR. CHARLES A. ELSBERG said that he personally had had two cases of pontocerebellar acoustic tumors, and in four more cases he had explored the cerebellar region for tumor. In all of his cases the diagnosis of tumor had been made by neurologists. His first patient was operated on in 1905, shortly after Dr. Woolsey had operated on his first case. The patient died on the third day from suppression of urine after the first stage of the operation had been done. The tumor was found in the exact spot where it had been located.

Dr. Elsberg said that after a careful study of these cases he had come to the conclusion that such a wide opening as was advised by Cushing or as was made in the patient shown by Dr. Meyer was unnecessary. If the bone was opened on one side, with free invasion of the corresponding mastoid, a good view of the cerebellum and the pontocerebellar angle could then be obtained by the use of retractors. The speaker said that after working out this method on the cadaver he had learned later that a similar method of approach had been proposed by Krause of Berlin; he had employed it in cutting the auditory nerve in a case of severe tinnitus aurium. The speaker made use of retractors of different sizes, carefully inserted, to draw the cerebellum towards the median line.

In a case which he saw last summer, Dr. Elsberg said, he removed an acoustic nerve tumor about twice the size of an almond. The operation was done in two stages. The patient improved steadily for a time, but ten weeks after the operation he showed symptoms of a recurrence and succumbed suddenly. The postmortem revealed a second tumor—a neuro-fibro-sarcoma lying in the middle fossa, on the base. This second tumor lay in an inaccessible region.

In not a single one of the patients operated upon by the speaker were there any marked respiratory symptoms from pressure on the medulla during the operative manipulations. With a wide opening in the skull and dura and proper care in manipulating the cerebellum, the danger from pressure on the medulla should be a small one. It is neither necessary nor advisable to follow the suggestion of Frazier—*i.e.*, to excise part of the cerebellar lobe in order to expose the cerebellopontine angle.

DR. MEYER, in closing, said the microscopic examination of the growth removed in his case showed fibrosarcoma. The dangers of operation in this region, the speaker said, were largely due to compression of the medulla and pons. By removing a larger section of bone, tying off and dividing the longitudinal sinus and turning down a horseshoe flap of the dura mater, we were in a better position to successfully deal with growths of any size.

CARCINOMA OF THE INNER SIDE OF THE CHEEK, INVOLVING THE ALVEOLAR PROCESS OF THE JAWS AND A PORTION OF THE FLOOR OF THE MOUTH AND HARD PALATE.

DR. L. W. HOTCHKISS presented a man, 52 years old, who was admitted to Bellevue Hospital on January 1, 1908, with an extensive epithelioma of the right cheek and jaws. His previous history was negative as regards venereal disease and traumatism, but he had been an habitual pipe smoker. His trouble had begun about five months previous to his admission, when he noticed a small ulcer of the mucous membrane of the right cheek at a point which was constantly irritated by being caught between his teeth. This ulcer had steadily increased in size and for the past six weeks had begun to be very painful. The entire side of the face was swollen, the pain increased so as to become unbearable, and the skin of the outer surface of the cheek had become adherent and had finally perforated. Trismus was marked, and any attempt at eating was intensely painful. He could swallow only milk and broths, and opiates were necessary to induce sleep. A section of the growth was examined by the pathologist and pronounced an epithelioma. There was moderate glandular involvement in the submaxillary and superior carotid regions, but no evidence of internal metastasis.

Operation, January 20, 1908. This was necessarily a very extensive one. The growth, together with one-half of the lower jaw and the alveolar process of the upper jaw, and a portion of the malar bone and palate, were removed. The large gap left in the cheek was filled by a plastic flap of corresponding size which had been fashioned at the beginning of the operation. The technic of the method would be described in a paper on the subject by Dr. Hotchkiss which would appear later in the ANNALS

OF SURGERY. The patient's condition had steadily improved since the operation; he was able to work and had gained considerable in flesh and strength.

ACUTE INTESTINAL OBSTRUCTION; ENTEROSTOMY;  
RESECTION OF COLON.

DR. F. KAMMERER presented a man of 41, who had suffered for three weeks from occasional griping pains in abdomen, vomiting and obstinate constipation. Outside of difficulty in moving his bowels he had not been ill previously, but had noticed a falling off in weight. When he came to the hospital he presented symptoms of subacute obstruction, which became acute on the third day. Paroxysmal intestinal peristalsis was marked in his case. No tumor could be felt. Intestinal peristalsis seemed to cease at the cæcum, although the epigastrium was somewhat distended. An incision was made over the cæcum, when the enormously distended intestines presented themselves. On introducing the hand into the abdomen a constricting tumor was discovered a little below the splenic flexure of the colon. An artificial anus was established at the cæcum. Several weeks later, with an incision on the left side at the outer border of the rectus, the tumor was excised, followed by an end-to-end suture. Finally the artificial anus was closed. The case emphasized the difficulties of localizing the area of obstruction, and the advisability of establishing an artificial anus in cases of great distention, when dealing with the chronic variety of intestinal obstruction.

SYNCHRONOUS LEFT URETEROSTOMY AND RIGHT NE-  
PHROSTOMY FOR HYDRONEPHROSIS, DUE TO URE-  
TER OBSTRUCTION BY BLADDER TUMOR;  
PERMANENT DRAINAGE.

DR. F. TILDEN BROWN read this paper and presented the patient upon whom the operation was done.

DR. R. HIRAM LOUX, of Philadelphia, said that unfortunately there were a certain number of cases in which some method of draining the kidney must be carried out, either by transplantation of the ureter into the bowel or by some external apparatus. About three or four years ago, Dr. Loux said, he saw a case of recurrent formation of calculi in the calyces of both kidneys. After several operations had been done for their removal the

kidneys became infected and urinary fistulæ formed, necessitating permanent external drainage.

DR. CHARLES H. PECK said that about a year ago he saw a case of complete ureteral obstruction of the right kidney, 48 hours in duration, in a woman whose left kidney had been removed for a partial hydronephrosis. In order to relieve her, a nephrostomy was done and the kidney drained through the cortex. A few days later a ureteral catheter was passed from below, through which the kidney drained perfectly well, but upon its withdrawal the retention recurred. A plastic operation was then done at the junction of the ureter with the pelvis of the kidney but the attempt to re-establish the patency of the ureter failed and a permanent nephrostomy opening had to be left. The urine drained through a rubber catheter which was attached to the thigh. For upwards of a year after this operation the patient remained in good health and was able to attend to her duties. Then she developed some nasal trouble which required operation; this resulted in infection and a fatal meningitis.

## BOOK REVIEWS.

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ABDOMINAL HERNIA; ITS DIAGNOSIS AND TREATMENT. By W. B. DE GARMO, M.D., New York. Professor of Special Surgery (Hernia), New York Post-Graduate Medical School and Hospital; Fellow New York Academy of Medicine. J. B. Lippincott Company, Philadelphia and London, 1907.

It is to the physician that this book is especially addressed, and it is in order to enable him to diagnose and advise the proper treatment of abdominal hernia that De Garmo has written upon this subject. The work contains an introductory chapter on the surgical anatomy of the inguinal region; there is nothing especially new described here. Inguinal hernia is then taken up, the cause and types are discussed, as well as the symptoms and diagnosis. An important and at the same time unusual chapter is that on the mechanical treatment of inguinal hernia, and it is this which will particularly appeal to the medical practitioner. There are described the various forms of trusses and their mechanism is carefully explained as well as the reasons for failure in some of them. It is interesting to note that it was a medical man who had the honor of having made the most valuable suggestions in the manufacture of the hard rubber truss, with which the names of Riggs, Chase and Hood will always be associated. There follows a chapter on truss-fitting, which most physicians are willing to leave to the truss maker. It is, however, most essential that physicians should understand when a truss fits properly. The physician should be able to write a prescription for a truss as he would for any other kind of treatment. The mechanical treatment of inguinal hernia in infancy and childhood forms another most important chapter. One-half of all the abdominal herniæ occur during the first five years of life, and it is during this period that the defect must be cured if it is ever to be accomplished without operation. It is not a difficult matter and should be thoroughly under the control of the family physician. It is not sufficient for the physician to prescribe a truss for such a patient; he should also regularly inspect the case and make such changes

as are necessary. Dr. De Garmo instructs us in the management of these cases. Works relating to abdominal hernia seldom mention gymnastics as an aid in palliative or curative treatment, but many cases may be improved by their use while others may be enlarged by the improper use of physical exercises. There is an interesting chapter on this subject.

DISEASES OF THE GENITO-URINARY ORGANS AND THE KIDNEY.

By ROBERT H. GREENE, M.D., Professor of Genito-Urinary Surgery at the Fordham University, New York; and HARLOW BROOKS, M.D., Assistant Professor of Pathology, University and Bellevue Hospital Medical School. Octavo of 536 pages, profusely illustrated. Philadelphia and London: W. B. Saunders Company, 1907.

The present volume has been compiled conjointly by a surgeon and a physician. It takes up first the general examination of the patient and then the special examinations including the care of urethral instruments and examination of the urine. The chapters on cystoscopy show some advance over other of the more recent publications in that the newer American instruments have been described, directions given for their use and for catheterism of the ureters. There are chapters on the blood in diseases of the kidney, the ocular manifestations of renal disease, the kidney in acute infectious diseases, Bright's disease and uræmia. In reviewing the book as a whole it shows that the medical side of the subject has been more thoroughly discussed than the surgical side; the chapters on Bright's disease, urethritis and prostatitis are more extensive and more comprehensive than are those on the surgery of the kidney and bladder. Why authors should continue to classify tuberculosis of the bladder with cystitis it is difficult to understand; tuberculosis of the bladder is as distinct a lesion as is carcinoma of the bladder, and gives rise to many of the same symptoms. The disease should occupy a chapter by itself, and the importance of early diagnosis should be emphasized. The injection treatment of the disease is the only one advocated. Under the consideration of stone in the bladder, the authors tell us that the symptoms closely resemble those of chronic cystitis; the picture, as a rule, is so different, that the description should not go unchallenged; the pain and suffering in many cases is extreme. Little reference is made to microscopic examination

of the urine, previous history of stone in the kidney, passage of gravel, and so on. For the relief of this condition—in describing the suprapubic operation—a six-inch vertical incision is advised; in many cases this would bring the incision nearly to the umbilicus and wounding of the peritoneum could not well be avoided. For the instruction of the general practitioner, the book is eminently fitted. The writers are conservative and the clinical material from which they have drawn their experience has been extensive.

ATLAS AND TEXT-BOOK OF HUMAN ANATOMY. Volume III.

By PROF. J. SOBOTTA, of Würzburg. Edited, with additions, by J. PLAYFAIR McMURRICH, A.M., Ph.D., Professor of Anatomy at the University of Michigan, Ann Arbor. With 277 illustrations, mostly in colors. W. B. Saunders Company, Philadelphia and London, 1907.

It is impossible, without actually seeing the volume, to appreciate the beauty and exactness of the illustrations which form a most important part of this work. It is safe to say that it is one of the most extensively illustrated works on anatomy ever published. The third and last volume of this Atlas includes the remainder of the vascular system and the entire nervous system together with the organs of the special senses. In many places the veins and nerves or the arteries and veins have been shown in the same illustration, which is a most important feature in view of the necessity of understanding the exact relations of these structures; it has the advantage that the student using the Atlas in the dissecting-room, can find the great majority of structures in the given dissection shown in a single illustration. The chief aim of the author has been to produce a useful book for the medical student and the physician, and although he does not claim that it appeals to the finished anatomist, still it does that to a greater extent than most of the recent works on anatomy. The text matter has been cut down so as to occupy as little space as possible. Volume I treats of the bones, ligaments, joints and muscles: Volume II of the viscera, including the heart: Volume III of the vascular system, lymphatic system, nervous system, and sense organs. As has been stated above, no one can appreciate the character of the book without reviewing it for himself.

A TREATISE ON FRACTURES AND DISLOCATIONS. By LEWIS A. STIMSON, B.A., M.D., Professor of Surgery in Cornell University Medical College, New York. New (5th) edition, thoroughly revised. Octavo, 847 pages, with 352 engravings and 52 plates. Lea Brothers & Co., Philadelphia and New York, 1907.

This treatise, which is now in its fifth edition, has been repeatedly reviewed in the *ANNALS OF SURGERY*, and it is not necessary to mention again at length the character of the work. It is not the work of a novice for Professor Stimson has been devoting himself to the study of fractures and dislocations for many years, and has gained much experience in the Hudson Street Hospital where the traumatic cases practically include all of the various forms of injury which are described in the treatise. Since the Röntgen rays have been introduced and have afforded a more exact method of studying these lesions than was formerly possible, it has been demonstrated that many fractures which seemed to be satisfactorily reduced and adjusted are, in fact, in very poor position, although the functional result is perfect. Although the medical practitioner is loth to assume the responsibility of a complicated fracture, those who are situated far from the great centres must assume this responsibility however limited may be their experience; to these men, especially, the book of Professor Stimson appeals.

A TEXT-BOOK OF MINOR SURGERY. By EDWARD MILTON FOOTE, A.M., M.D., Instructor in Surgery, College of Physicians and Surgeons, Columbia; Lecturer on Surgery, New York Polyclinic Medical School. 407 illustrations; pp. 713. D. Appleton & Co., New York and London. 1908.

The author in this present work has given to surgical literature a contribution which is notable for its completeness and for the omission of any procedures belonging to major surgery. The book covers those conditions whose description and treatment rarely find sufficient elucidation in Manuals of General Surgery. In reading Dr. Foote's work, one can well imagine a morning spent in a large public clinic such as that of the Vanderbilt or Bellevue.

The author has had a vast experience, indeed, from which to draw information. His teaching he has set forth in a clear,

terse manner, the text being illustrated by frequent apt and instructive cuts—certainly a relief is experienced on noting their originality. To the young physician who has not had the advantages of a hospital or clinical training, the book will be of special value.

The subject matter is classified regionally into seven sections; affections of the head, neck, trunk, genito-urinary organs, anus and rectum, arm and hand, and the leg and foot. In each section a general schematic arrangement is carried out; thus, for affections of the trunk, he discusses in order, *traumatisms*, including contusions, wounds, sprains, fractures, dislocations, *acute inflammations*, *chronic inflammations*; *neoplasms*, including cystic tumors, solid benign tumors of trunk, solid tumors of breast, malignant tumors of trunk, and *deformities* acquired and congenital. This outline is, of course, varied in other regions of the body where special affections, such as foreign bodies, burns, amputations, etc., may occur, but all parts are treated fully, concisely and exhaustively.

The book concludes with a section devoted to Minor Surgical Technique, considered in three chapters, namely: Operative Technique, divided into conditions of operation, treatment of the wound, and some typical operations; the Roller Bandage, sub-divided regionally into general considerations, bandages of head, neck and axilla, alone and in combination, trunk, upper extremity and lower extremity; Surgical Dressings, taking up the questions of textile materials, ligatures and sutures, drains, splints and gypsum applications.

Dr. Foote's book is a welcome and valuable contribution to the field of minor surgery, a field which in recent years has been somewhat neglected owing to the wonderful strides made in major surgery.

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## ORIGINAL MEMOIRS.

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### THE TREATMENT OF THE UNDESCENDED OR MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA.\*

BY WILLIAM B. COLEY, M.D.,

OF NEW YORK.

Surgeon to the General Memorial Hospital; Associate Surgeon to the Hospital  
for Ruptured and Crippled.

AN undescended testis is not such a very rare complication of hernia, as the statistics at the Hospital for Ruptured and Crippled, as well as those of the London Truss Society show. In 59,235 cases of inguinal hernia in males observed at the Hospital for Ruptured and Crippled from 1890-1907, there were 737 cases of undescended testis.

The basis of the present paper is a study of 126 cases upon which I personally operated. In spite of the fact that the subject has received considerable attention in the last few years (and was the main topic of discussion at the meeting of the French Surgical Society, a year ago) there is by no means unanimity of opinion as to the indications for surgical treatment, and there is also a wide difference of opinion as to the best methods of operation. Furthermore, few large statistics exist in which the after-results of operation are

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\* Read before the New York Surgical Society, April 22, 1908.

stated, and it is with special reference to this point that I trust that my own series may prove of interest.

The testis is first placed in the lumbar region, a little to one side of the vertebra, close to the primitive kidney. It descends along the posterior abdominal wall accompanied by or rather following the vaginal process of peritoneum which has preceded it, until it finally reaches the bottom of the scrotum.

In certain cases and due to a variety of causes, its downward progress may be interrupted at almost any point, giving rise to the different types of undescended or maldescended testis. If its progress is stopped before it enters the inguinal canal, it is called abdominal ectopia; if it is stopped within the inguinal canal, it is called inguinal ectopia; if it passes outward to the external canal into the region of the upper scrotum, it is called pubic ectopia.

The varieties thus far mentioned refer only to cases of interruption of the organ in its normal descent. There are cases, however, which, instead of being described as "undescended testis" more properly come under the heading of maldescended testicle, the testicle occupying some abnormal position, *c.g.*, perineum, Scarpa's triangle, or the aponeurosis of the external oblique, in the region of the anterior superior spine. These different varieties may be designated as inguinoperineal, inguinoperineal, and inguinocrural ectopia.

Perineal ectopia, although described by Hunter in 1786 and afterwards by Curling in 1841, has received very little attention by surgical writers. Curling was the first to give a detailed description of the condition in 1857, and a report of 9 collected cases. He was also the first one to treat the condition by operation. The patient was an infant 4 weeks old. The result of the operation was unfortunate.

Godard in 1857 and 1860 reported two interesting cases, one a man 56 years of age, another of 22. The first case was originally an inguinal ectopia which, after having worn a bandage for a considerable time, became perineal; the second case was cruroscrotal ectopia.

In 1858 Partridge reported a case in which he performed castration. Some years later, James Adams reported the 13th case treated by operation up to that time. The patient died of peritonitis following the operation.

Annandale in 1879 was the first one who reported a case successfully treated by surgical intervention.

Monod and Terrillon in 1889 collected 30 cases of perineal ectopia, which number Weinberger in 1899 increased to 65. Adding to this the more recent cases collected by Klein in his admirable "*Thèse de Paris*" on Ectopia, we have a total of 81 cases up to this date.

As to the frequency of perineal ectopia, Rennes and Marshall report only 17 cases of ectopia in 14,400 recruits examined for military service, but not one of these is stated to be perineal.

Godard in 53 cases of ectopia found only 3 examples of the perineal variety.

McAdam Eccles in his work on the imperfectly descended testis states that out of 936 instances of imperfect descent of the testis, associated with hernia, only 5 were found to be of the perineal variety.

My own statistics show 9 examples of perineal ectopia in 126 cases of hernia with undescended or maldescended testis operated upon.

At the Hospital for Ruptured and Crippled there have been observed during the past 18 years 737 cases of undescended testis, and of these only 15 were of the perineal type. In 6 no operation was performed.

As regards the age of the patients, while the disease is of congenital origin, the testis is not always found in the perineum at birth. In certain cases it is situated just outside of the inguinal ring, or has passed below the pubic bone, and later on reaches the perineum. In practically all of my own cases the testis had always been present in the perineum, as far as was known. In the great majority of cases the condition is unilateral.

Hutchinson has reported one case in which both testicles

in a total of 2200 operations for hernia of all varieties were in the perineum, and Ammon has published a second such case.

*Heredity.*—Godard mentions a case in which the condition occurred in father and son, and Klein reports a case in which the brother of a patient had multiple dystrophies, particularly hypospadias.

*Etiology.*—Authorities differ widely as to the precise cause of descent of the testis into the perineum. Until recently there was a tendency to accept fully the opinion of Curling that had become almost classic, that the principal and almost only agent connected with the descent of the testis was the gubernaculum; and as the latter was admitted to have several fasciculi, one attached to the lower part of the scrotum another extending into the perineum to the margin of the ischium and a third into the pubic or femoral region, this seemed an easy and sufficient way of accounting for the different types of maldescent of the testis. In the perineal variety the fibres were supposed to be more fully developed than in the inguinal type, and by traction the testicle became lodged in this region.

Godard accepted the theory fully and believed nothing more simple than this explanation,—no gubernaculum and the testis remains within the abdomen; no middle fasciculus, and inguinal ectopia occurs, while in the event of the anomalous insertion of the fasciculus either in Scarpa's triangle or the ischium, we have cruroscrotal and perineal ectopia.

However, Bramann, in 1884, made a very careful study of 40 human embryos with special reference to the migration of the testicle, and as a result of these investigations declared that he had never been able to determine that the vaginal sac divides the fibres of the gubernaculum as it becomes inserted in the bottom of the scrotum.

Lockwood, in 1887, made one of the most careful anatomical studies of the undescended testis that has ever been made, and proved anew the plurality of the inferior insertions of the gubernaculum, and showed that during the 6th and 7th

month the fibres of the latter penetrate the inferior portion of the abdominal wall and extend into the triangle of Scarpa; others are attached to the pubis and root of the penis; others again extend behind the scrotum; in the 8th month, as dissections have shown, many of the inferior fibres of the gubernaculum pass into the peritoneum ending in the tuberosity of the ischium or become one with the sphincter ani.

Lockwood believes the gubernaculum the main factor in the descent of the testes, and attributes the various types of maldescent to over-development of portions of the gubernaculum lying in these particular regions. He states: "The muscular structure of the gubernaculum is, I think, unquestionable, and it seems irrational to deny its tissues their function, namely, that of traction." He regards it of special significance that in case of maldescent, the testicle migrates into particular regions in which, as has been well established, the fibres of the gubernaculum exist. I do not believe that Lockwood's argument is entirely convincing.

Later, Sébileau, after careful personal research upon the coverings of the testicle and its migration, concludes that "perineal ectopia is a purely congenital affair. It depends neither upon pathological nor anatomical causes and least of all upon the gubernaculum." He recognizes that the absence or insufficient development of the gubernaculum may explain abdominal and iliac retention. As regards the inguinal and extra-inguinal, he believes that the abdominal wall itself plays a very real and important rôle in offering difficulty to the complete passage of the testicle through the external ring.

Championniere in his "clinical lecture on anomalies of the testicle," gives the result of 44 operations in 39 patients. He strongly opposes the theory of the gubernacular origin of the undescended testis and says that only a physiology as legendary as that which, in former times, accepted multiple testes as proven facts, can seek to explain the descent of the testis by a legendary origin of the gubernaculum testis. The defects of the gubernaculum are invoked as a cause of non-descent and, quite naturally, these writers seek to supply its deficient

action by traction made upon the testicle either in the direction of the scrotum or in the direction of the thigh by structures more or less doubtful. Without discussing this, as he terms it, childish theory of the gubernaculum testis, Championniere states that we must admit that we do not know the cause of this descent. We can, however, generally affirm that we do know certain conditions which hinder it.

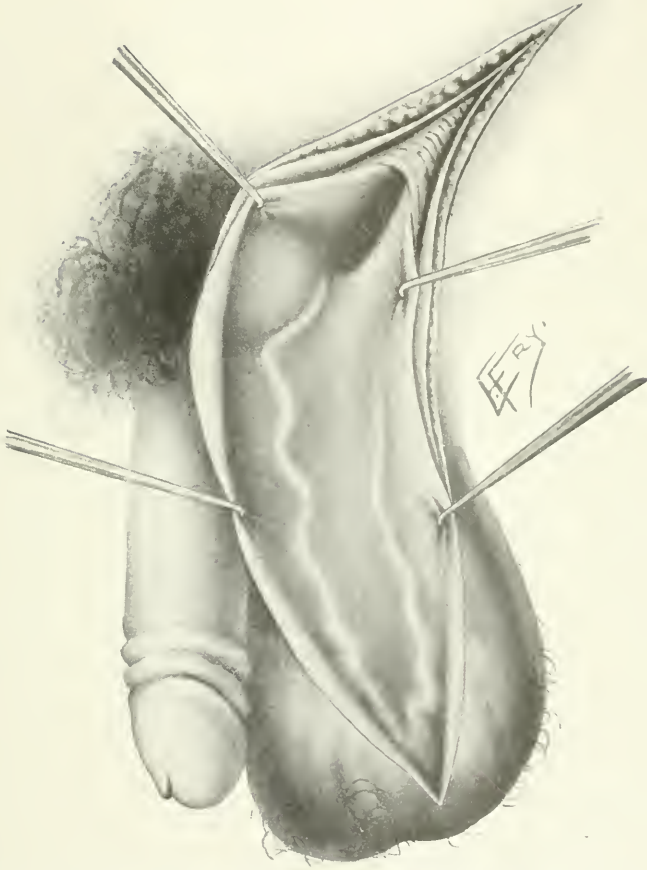
Championniere concludes from his observations that an ectopic testicle should always be preserved for the reason that, although it may have no functional value, it has an important influence upon the general health and virility of the subject. His own series of cases however shows that in 15 cases the testicle was sacrificed and in 19 cases orchidopexy was performed.

Among the chief reasons which have influenced Championniere as well as others to sacrifice the testicle, has been the idea that by so doing a radical cure of the accompanying hernia would be more certainly effected. However, Championniere's own statistics as well as those of other men, have shown that the herniæ remained cured in practically all cases without regard to whether or not the testicle has been removed. Hence, such reason for orchidectomy no longer obtains.

Championniere believes that a hernia practically always accompanies ectopia of the testicle of whatever variety and adds that although he performed two operations for ectopia without finding a hernia, one of these was an old operation and his not finding the hernial sac may have been due to inexperience. My own experience is entirely in harmony with this view. In not a single case of my entire series, 126 in number, did I fail to find a hernial sac.

Büdingen, one of the most recent writers upon the etiology of the undescended testis, states that he has operated upon 24 cases of inguinal retention of the testicle and that mechanical obstruction of some sort was found to be the cause of the nondescent of the testicle in 15 of these cases. A certain number of anatomical investigations upon cadavers confirmed the result.

FIG. 1.



Rare type of undescended testis, with hernial sac and cord extending to bottom of scrotum. Testis arrested at external ring.



One of the latter, a man 40 years of age, was brought to the hospital with cryptogenic pyæmia of which he died. Autopsy revealed the following conditions: The connective tissue of the scrotum proved absolutely normal; the hernial sac and tunica vaginalis propria were found loosely embedded; nowhere was there a structure that could in any way be brought in connection with a gubernaculum. The tunica vaginalis propria was greatly thickened, the sac elongated upward into the shape of a diverticulum. A band extended from the upper portion of the tunica vaginalis along the outer side of the testicle and epididymis, in its lower portion becoming one, partly with the tunica vaginalis, partly with the epididymis.

Büdinger states that while cicatricial adhesions between testicle and epididymis and intestines are given as one of the causes of retention by all authors, his experience has shown him that, though often seen, these phenomena are much less frequent than those peritoneal changes which, while having no direct connection with the gland, nevertheless interfere in an unequivocal manner with the motility of the testicle. He believes the adhesions of the testicle itself to represent an accidental localization of an extensive inflammatory process, rather than a cause in itself of the retention of the organ, and that cicatricial retraction of the peritoneum after inflammatory processes that take place prenatally or in earliest infancy, in the neighborhood of the inguinal canal, using up large areas of peritoneal covering, are a far more frequent cause of retention of the testicle. An undescended testis may prove an abnormally long cord, as shown by Fig. 1.

One of the most valuable of recent contributions to our knowledge of the undescended testis is the paper by Odiorne and Simmons (*ANNALS OF SURGERY*, Dec., 1904.) This paper is based upon a careful study of 77 cases observed at the Massachusetts General Hospital from 1877 to 1904. Inasmuch as orchidectomy was frequently employed, the microscopic study of the testicles removed has added considerable to our knowledge of the pathology of the undescended testis. It was shown that the tunica albuginea was more or less thickened in all the specimens examined, two being "five times thicker than the normal organ," and the interlobular connective tissue, while varying in amount, was generally increased. One of the most striking features of the unde-

scended testis was the "interstitial cells," which were found in all cases and generally in large numbers. These cells, while present in children in whom the testicles have normally descended, are not found in the adult organ. Their function is largely a matter of conjecture. According to Monod and Arthaud they are more often seen in the neighborhood of blood vessels. The specimens described by Odiorne and Simmons exhibited no definite relation to any structure of the testis; they were endothelial in type and of large size, with rounded nuclei.

The undescended testis shows another variation from the normal in the thickening of the basement membrane of the tubules. The epithelial lining of the tubules also shows very marked changes, the epithelial cells being few in number and more or less degenerated and irregular in shape. The so-called Reinke<sup>1</sup> crystals are usually seen in the interstitial fibrous tissues of the undescended testis. The nature and function of these crystals has as yet not been fully determined.

As regards treatment, no uniform method was employed, as the 77 cases were under the care of 15 different surgeons during the period of 27 years. In 28 cases orchidectomy was practised. Of these 17 were performed since 1900, 5 of which were in children, *i.e.*, in cases under 16 years of age. In four cases the testis was reduced into the abdominal cavity. In only 18 cases, 11 adults and 7 children, between 5 and 13 years of age, was orchidopexy performed, or an attempt made to bring the testis into the scrotum.

A perfect result was obtained in only 2 instances of the 7 children; this was in a patient with double retention; in 2 others the result was satisfactory, the testicle having remained in the upper portion of the scrotum. Of the 11 operations done upon adults between 16 and 42 years, 5 remained in the scrotum, one in perfect position, three retracted soon after operation into the canal, where they remained much atrophied; one is the cause of considerable pain. Two retracted into the

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<sup>1</sup> Arch. f. mikr. Anatomie, 1896, p. 34.

pubic region, where they were the source of considerable annoyance, owing to their position.

This analysis suffices to prove that at present there is no definitely settled procedure of dealing with the undescended testis. There is agreement neither as to the proper age of interference nor as to the method of operation.

For many years—a century or more—it has been an almost universally accepted opinion that the undescended testis is peculiarly liable to undergo sarcomatous degeneration (Hunter, Godard, Curling).

McAdam Eccles (1903 Jacksonian Prize Essay) was the first to seriously question this opinion. He stated that close examination of upwards of 48,000 males with hernia, at the London Truss Society showed 854 cases of imperfectly descended testis, or about 2 per cent. In this series there was not a single example of sarcoma of the undescended testis. Furthermore, in 40 cases of sarcoma of the testis observed in one of the large London hospitals during a period of 20 years, there was only one case of sarcoma of the undescended testis. From these and other facts, he concluded that the generally accepted opinion could not be substantiated.

Since the publication of McAdam Eccles' paper, Odiorne and Simmons (*ANNALS OF SURGERY*, Dec., 1904) incline to accept the older opinion, in favor of which they cite 54 cases of malignant disease of the testis observed at the Massachusetts General Hospital during a period of 26 years. Of these 6, or 11 per cent. occurred in the undescended testis. They further state that Schödel, quoted by Von Kahliden, has reported 41 cases of sarcoma of the testis observed in a large London hospital in one year, of which 5, or 12 per cent. occurred in the undescended testis. This latter statement is clearly incorrect, since sarcoma of the testis is too rare a condition to be observed 41 times in a single hospital in one year.

McAdam Eccles states that among 4,200 male patients admitted annually to a large London hospital, there has been only an average of 2 cases of sarcoma of the testis during a period of 20 years.

Our observations at the Hospital for Ruptured and Crippled are quite in harmony with the facts related by McAdam Eccles. Since 1890 59,235 cases of hernia in males have been observed, in only 737 of which an undescended or maldescended testis was found, and not a single case of sarcoma of the undescended testis.

Personally, I have observed 34 cases of sarcoma of the testicle. The first 25 all occurred in normally descended testes, in the 26th and 27th and 34th cases the sarcoma developed in an undescended testis; all were examples of abdominal ectopia. This would make 8.8 per cent. of sarcomas of the testis originating in the undescended organ.

While the facts submitted by Eccles as well as the statistics at the Hospital for Ruptured and Crippled do not fully justify his conclusion (for the reason that a patient with a sarcoma of the undescended testis would not necessarily go to a hernia clinic, but to a general hospital) it is probably true that the danger of the undescended testis from the development of sarcoma is much less than has generally been supposed. It should be noted that the danger is much greater in abdominal than in the other varieties of ectopia.

Many surgeons have advised operation in the very young children, *e.g.*, 2 years of age or even younger. Such practice ignores the fact that in a large proportion of cases of undescended testis in young children, the organ will reach the scrotum by the age of puberty without surgical interference. In just what proportion of patients the undescended testis finally reaches the scrotum, has never been determined, I am at present engaged in tracing a large series of non-operated cases observed from 5 to 15 years ago.

That this is true is shown by the study of the statistics of any large hernia clinic. Of 739 cases of undescended testis observed at the Hospital for Ruptured and Crippled, since 1890, 561 occurred in 18,410 children under the age of 14 years, or 3 per cent; while only 92 cases occurred in 3,848 between the ages of 14 and 21 years, or 2.2 per cent.; and only 75 cases in 37,370 over 21 years of age, or .2 per cent.

That is, under the age of 14 years undescended testis is 15 times more frequent than after the age of 21 years.

Inasmuch as only comparatively few cases have been cured by operation during this period, the only conclusion is that the majority of undescended testes seen in infancy and early childhood eventually reach the scrotum through natural causes before the age of 14 years. Still another reason for deferring operation is the fact that the results of operations performed between the ages of 12 and 14 years are far better than those of an earlier age. One reason advanced in favor of early operation is that hernia associated with undescended testis is far more liable to strangulation. This assumption I believe to be incorrect, and not supported by facts. We have never observed a case of strangulation of a hernia with undescended testis at the Hospital for Ruptured and Crippled.

The results of the treatment of the undescended testis in France, as brought out at the Congress of Surgery in 1906, were as follows:

Villard reported 116 operations, with 56 perfect results, 42 doubtful ones and 18 failures. He stated that as a result of operation there is usually decrease of pain and increase of the virility of the individual, but the influence upon spermatogenesis is practically nil.

Kernisson, of Paris, reported 80 operations for undescended testis from 1898 to 1905, without any serious complications. Thirty-nine were examined as regards late results. Of these the testis was found in the scrotum in 15 cases; in ten at the root of the scrotum; in 9 at the orifice of the inguinal canal. In 2 or 3 cases only was the testicle well developed. In 10 cases associated with hernia, Bassini's operation was performed.

De Page reported 20 cases, of which 5 were double. Ten were traced, and in 7 of these the testicle was found in its normal position; in three others the testicle had retracted toward the external ring.

As regards the indication for operation, Villard would

not operate upon the abdominal variety of ectopic testis, for the reason that the operation is dangerous and the result uncertain. In simple cases, not complicated with hernia, he advised non-interference under the age of 10 years, and then closing the canal by Bassini's method.

While some of the surgeons advised operation in childhood as early as the second or third year, *e.g.*, Girard, the weight of opinion was in favor of postponing the operation until at least the fifth or sixth year and some until the age of ten, *e.g.*, Villard and Kernisson.

Broca's results still remain the most complete and most comprehensive (Bulletin Soc. de Chir. 28, 1902, p. 761). He reported 138 operations for inguinal ectopia associated with hernia, all cases occurring in children. Sixty-two patients with 79 operations were examined at periods of one year and upward after operation. Thirty-one showed perfect results; 35 fairly good results. Thirteen cases may be classed as failures as regards the testis remaining in position, although there was no return of the hernia. In all of these cases the testis showed more or less atrophy and in most of the cases the atrophied testis had retracted to the neighborhood of the external ring, or in some cases into the canal itself.

#### METHODS OF OPERATION.

The various methods of operation may be classified as follows: (1) Freeing the testicle and cord, with suture of the testis to the scrotum itself (Wood, Nicoladoni, Horsley); (2) freeing the testicle and anchoring it to the testis on the opposite side (Tuffier, Championniere, Sébileau); (3) cutting away all the structures of the cord except the vas and its vessel, then anchoring the testicle in the scrotum by placing the testis in the scrotum with or without suture (Mignon and Bevan). Suturing the cord to the tissues forming the external ring (Rieffel).

A number of other methods have been proposed, though not extensively followed, *e.g.*, pushing the testicle through an opening in the scrotum and burying it in the tissues of the

thigh temporarily, later returning it to the scrotal cavity (Keetley). Most surgeons, with the exception of Broca, close the inguinal canal by Bassini's method. Bevan was one of the first to recognize the disadvantages of this method of closure, inasmuch as a gain in length of the cord of  $\frac{1}{2}$ –1 in. or more may be obtained by not transplanting the cord, bringing it out at the lower angle of the wound (modified Bassini).

The method of operation which I have employed has been: Bassini's incision, freely opening the aponeurosis of the external oblique as high up as possible, surrounding the cord and hernial sac, which latter has always been found present. Grasp the lower portion of the tunica vaginalis and by traction bring the testicle as far down as possible. Next, separate the sac from the cord, high up, just outside the internal ring. (In children this requires very careful and delicate dissection, as the cord is usually greatly enlarged and spreads out in a fan-like manner over an area of the sac 1–2 in. in size.) If the dissection has been begun at the right layer, the sac can be isolated and is then tied off as high as possible. In most cases of inguinal retention the cord can then be freed sufficiently to permit the testicle to be brought at least into the upper portion of the scrotum, in most cases into the lower part, with the sacrifice of but few, if any, of the veins. Except in a very few of the early cases, I have never made any attempt to anchor the testis in the scrotum, but rely upon careful freeing of the cord high up. Suturing of the testicle within the scrotum is, in my opinion, of little value. If there is any tension, the scrotum is retracted up toward the external ring. The canal is then closed by the modified Bassini method, *i.e.*, the cord is brought out at the lower end of the wound; the internal oblique is then sutured to Poupart's ligament over the cord. Great care is taken in placing the lowermost suture, which should include the reflected portion of the external oblique as well as the conjoined tendon and Poupart's ligament on the outer side. This suture, when tied, makes but a very small external ring, too small ever to permit the testis to retract into the canal, even should it reach the ring.

Bevan in 1899 and later in 1903 (Jour. Am. Med. Ass'n.) described a new method of operation for the undescended testis and strongly urged the more general employment of surgical treatment for this condition. His method consists in brief in a free opening of the canal by Bassini's incision of the skin and aponeurosis; cutting off the hernial sac high up beyond the internal ring; cutting away all the fascia and muscular fibres that hold the cord and testicle fixed in the canal; passing the finger into the iliac fossa and stripping the vas deferens from the peritoneum by means of blunt dissection, even sacrificing the veins and spermatic artery, if necessary to secure sufficient motility of the testis, to permit of its being brought into the scrotum without suture. The canal is then closed by the modified Bassini method, without transplantation of the cord. The external ring is carefully sutured to prevent the testicle from again entering the canal, should retraction take place.

Up to 1903 Bevan had operated upon 20 cases, although the late results of these cases are not given. He advises operation in all cases in which the testis can be palpated and believes the most favorable age of operation to be between the sixth and twelfth year.

#### CASES OF MALDESCENDED HERNIA OF SPECIAL INTEREST.

##### (A) *Inguinoperineal Hernia.*

CASE I.—J. M., aged 27 years; congenital, right side. Operation in 1895, at the Post-Graduate Hospital. A tumor the size of a child's head occupied a large pouch made of the dilated skin of the peritoneum and extended to the margin of the anus. (Fig. 2.) The right scrotum was empty and atrophied; testicle at the bottom of the hernial sac. A regular Bassini incision was made and the pouch found to contain small intestine omentum and the testis. On reduction of the contents, the testis was found at the bottom of the sac in the peritoneum and greatly atrophied. The testis and cord were removed and the wound closed by Bassini's method. No relapse of the hernia one year later, at which time the patient was drowned.

FIG. 2.



Inguinoperineal hernia (case I) from photo

FIG 3.



Inguinoperineal hernia (Case VI).

CASE II.—W. G., aged 17 years; congenital, right inguinal hernia with perineal ectopia. Operation in 1901 at the General Memorial Hospital. The hernial sac was found to communicate with the abdominal cavity and, at the bottom of this, in the perineum about one inch from the margin of the anus, was the testis, almost normal in size. The regular Bassini incision was made in this case as in the preceding and the upper portion of the sac was removed and tied off flush with the abdominal cavity; a sufficient amount of the lower portion was left to furnish a new and complete covering to the testicle; it was united with purse-string suture. The testis was then transplanted into a pouch in the scrotum made by digital dilatation. Examination six years later showed the testis occupying a normal position in the scrotum and normal in size.

CASE III.—A. S., aged 35 years. The patient had noticed the hernia for only six years and had worn a truss the entire time. Operation July, 1896. The right scrotum was found to be empty and the testis which was atrophied to half normal size, was found in the anterior portion of the perineum. In this case the testis was not transplanted into the scrotum; wound closed by Bassini's method. Examination 5 years later showed the testis still occupying the anterior perineal region, no further atrophied.

CASE IV.—Infant, aged 7 months; left inguinoperineal hernia, sliding hernia of the sigmoid. Operation was undertaken at this early age for the reason that it was impossible to control the hernia by any form of truss. The operation was done at the Hospital for Ruptured and Crippled in Jan., 1908. The testis was found in the mid-perineum and normal in size; it was transplanted into the scrotum. The hernia was reduced and the wound closed by Bassini's method.

CASE V.—W. C., 16 years of age, had noticed a swelling in the right groin since a few days only. Physical examination shows the testis in the right mid-perineal region, a hernia in the canal, which, however, does not enter the perineal region. Operation Aug. 27, 1896, at the Post-Graduate Hospital. Bassini's incision for inguinal hernia. A small hernia sac is found extending down nearly to, but not communicating with the tunica vaginalis, which contained some bloody fluid in its cavity. The testis was found occupying the mid-perineal region and could be

pushed back almost to the anal margin. The right scrotum was empty and flat; the testicle and tunica vaginalis were dissected out from the perineum and transplanted into the scrotum in normal position. The inguinal canal was closed by Bassini's method. Examination 4 months later showed the testis of normal size, in the bottom of the scrotum.

CASE VI.—A. D., aged 29 years, admitted to the General Memorial Hospital in April, 1907, with a history of having had a swelling in the right mid-perineal region since childhood, which had given him considerable trouble of late in sitting and walking; the right scrotum had always been empty. Examination showed the right testicle occupying the mid-perineal region with the physical signs of an inguinal hernia passing down to the region of the testis. (Fig. 3.) Operation was performed in April, 1907. The testis was found to be normal in size; the hernial sac which communicated with the tunica vaginalis, was removed high up. Sufficient peritoneum was left to make a complete covering for the testis. The testis and cord were then transplanted into a pouch made by manual dilatation in the right scrotum. The wound was closed by the modified Bassini method, not transplanting the cord. The patient came to see me again in October. Examination at this time showed the testis had again retracted into the perineal region. I did a second operation, without opening the inguinal canal, brought the testis to the bottom of the scrotum and there sutured it with catgut. The testis has remained in perfect position since, the last examination having been made on March 28, 1908, six months later.

CASE VII.—T. E., aged 40 years. Right inguinoperineal hernia since infancy. Operation General Memorial Hospital, 1902. Testis transplanted into scrotum. Hernia wound closed by modified Bassini operation. Examination 5 years later showed testis in normal position. Testis slightly atrophied at time of operation, no further atrophy.

CASE VIII.—M. H., aged 5 years. Left inguinoperineal hernia. Operation Hospital for Ruptured and Crippled, November 15, 1895. Testis found in anterior portion of perineum, with hernial sac communicating with tunica vaginalis. Testis transplanted into scrotum. Wound closed by Bassini's method. Examination 8 years later showed testis in normal position; no atrophy.

FIG. 4.



CASE X. Inguinosuperficial hernia with bilocular sac. Strangulated omentum.  
No hernia ever noticed prior to strangulation.



CASE IX.—F. E., aged 40 years, had noticed swelling in the right perineal region since childhood. Operation at the General Memorial Hospital Oct. 1, 1902. Bassini's incision for inguinal hernia. The right testis was found in the mid-perineal region, the tunica vaginalis communicating with a large hernial sac which contained a mass of irreducible omentum. This was tied off in small sections and the stump reduced into the abdominal cavity. The testicle was transplanted into the right scrotum. Examination May 6, 1907, showed the result perfect.

In addition to the preceding cases, I have observed at the Hospital for Ruptured and Crippled since 1890, six other cases of perineal ectopia which were not operated upon. Whether or not the ectopia was associated with a hernia could not be determined without operation. One, aged 5 years, left side; another aged 21 months, right; a third aged 7 months, right side. The other three cases were in adults.

(B) *Inguinosuperficial Hernia With Undescended Testis.*

CASE X.—*Inguinosuperficial hernia with bilocular sac.*—That a diverticulum of peritoneum or hernial sac may occupy an unusual position irrespective of the action of the gubernaculum, is illustrated by the following case:

L. N., aged 30 years, was operated upon at the Post-Graduate Hospital, Feb. 25, 1897, for strangulated omental hernia of large size. The patient gave a history of having had no hernia nor even impulse on coughing prior to 24 hours before admission. While engaged in dancing a tumor appeared in the left iliac and scrotal region, about the size of a fist. It was very painful and could not be reduced. Nausea and occasional attacks of vomiting followed; but there was a small movement of the bowels. Physical examination showed a tumor occupying the upper scrotal region, extending up over the aponeurosis of the external oblique as far as the anterior superior spine. The whole tumor was completely dull on percussion. The diagnosis of strangulated omental hernia was made and immediate operation advised. On cutting through the skin a tumor was found emerging from the external ring, which was very tightly constricted and composed of two loculi, one passing down into the upper scrotum, the other upward, resting upon the aponeurosis of the external oblique. The

canal was first opened and then the sac, which was found to contain a large mass of deeply congested omentum, with several ounces of bloody serum; no intestine was present. (Fig. 4.) The testis was found to occupy the lower portion of the bilocular sac, the upper one containing only the imprisoned omentum. The patient made an uninterrupted recovery.

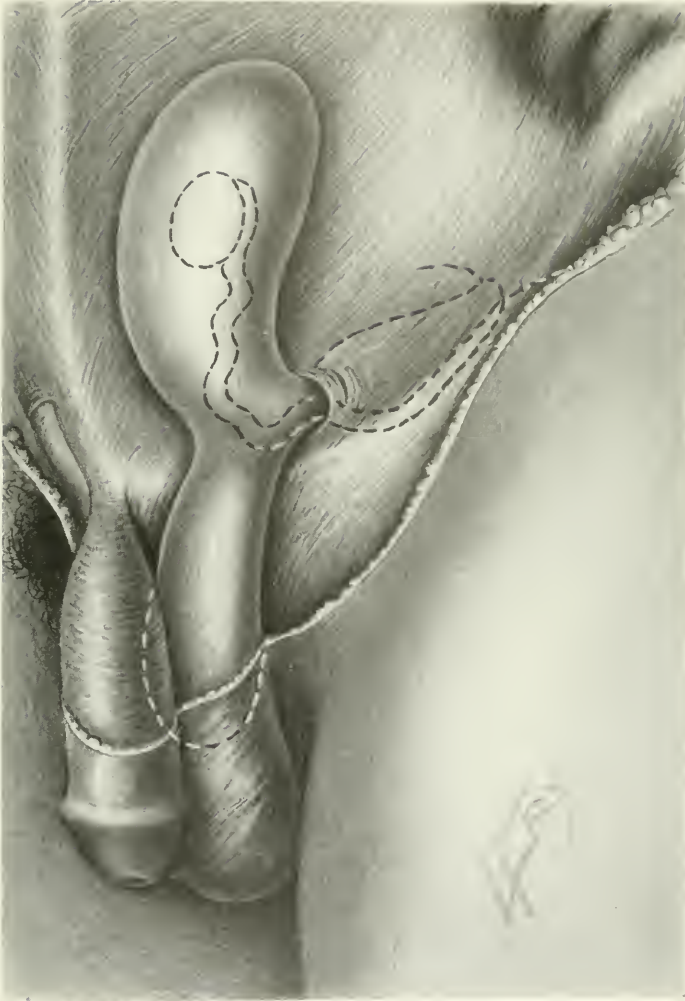
In this case we undoubtedly had to deal with a bilocular sac of congenital origin which had been entirely empty up to 24 hours prior to operation, when a mass of omentum was forced into the sac. The old explanation of such sacs being due to the gradual dilatation of a hernia prevented from passing downward by the testis, and following the line of least resistance upward, does not hold good in this case.

The recent investigations made by Murray, of Liverpool, who has examined 200 cadavers of adults who had had no history of hernia during life, showed that congenital diverticuli are by no means infrequently found in the femoral canal, he having found 47 such instances in the above series of examinations.

These facts, I think, enable us to explain perineal ectopia as well as the inguinoperitoneal variety, as the result of an unusual prolongation of a peritoneal diverticulum, rather than the result of traction of a more or less imaginary fasciculus of the gubernaculum.

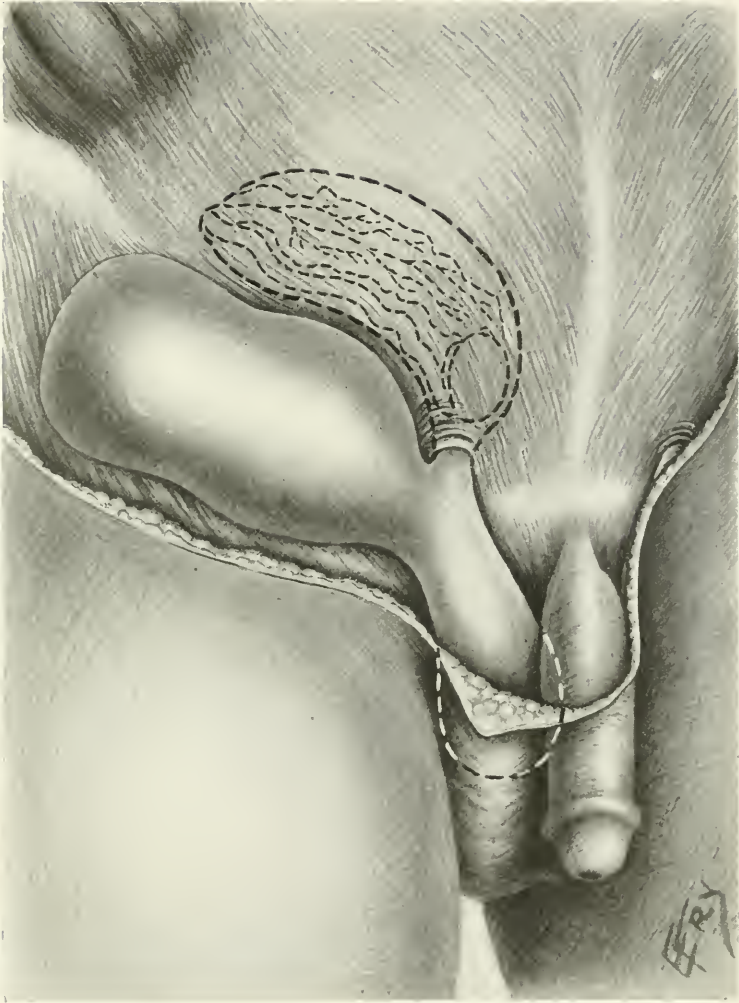
CASE XI.—*Inguinosuperficial hernia with trilocular sac.*—A. H., 24 years of age; right undescended testis with right inguinoperitoneal hernia. The patient gives a history of the testis never having been felt on the right side; a swelling having been noticed for a number of years, often disappearing on lying down. Operation March 1, 1908, at the General Memorial Hospital. On making the usual incision for Bassini's operation for inguinal hernia, cutting through the skin and superficial fascia, an empty sac was found resting upon the aponeurosis of the external oblique, and extending nearly to the anterior superior spine. The right scrotum was empty and the external ring small. On splitting up the aponeurosis of the external oblique, a second interstitial sac was felt situated between the external and internal oblique, about  $2\frac{1}{2}$  in. in diameter. At

FIG. 5.



Inguinosuperficial hernia. Bilocular sac with testes in upper loculus.

FIG. 6.



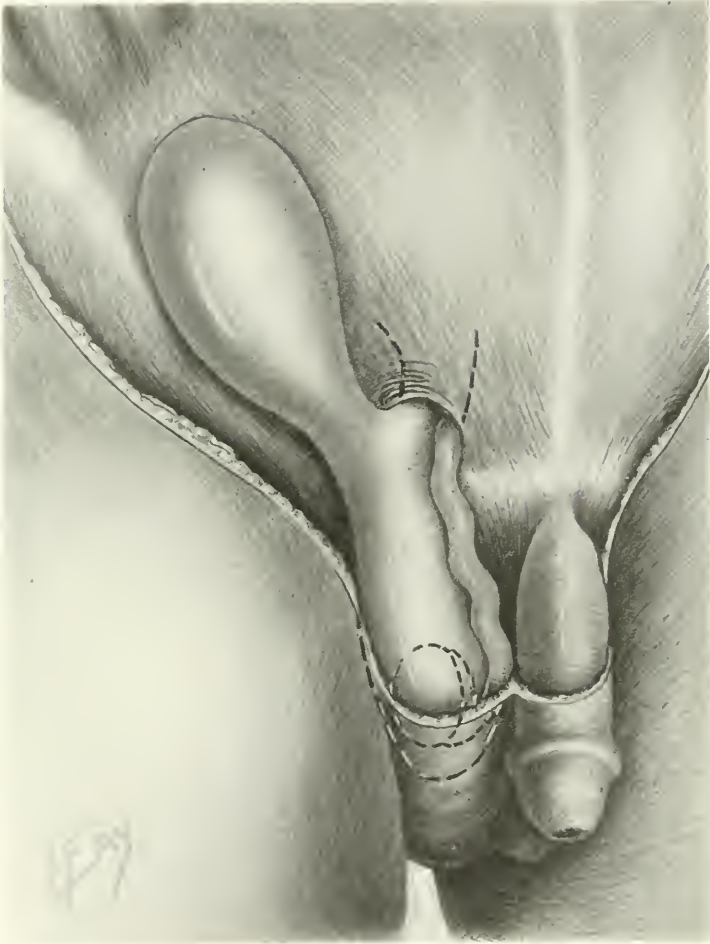
Inguinosuperficial and interstitial hernia with trilocular sac.

FIG. 7.



Inguinosuperficial hernia. From photo.

FIG. 8.



Inguinosuperficial hernia. Testis in upper scrotum.

the bottom of this sac, resting on the transversalis muscle and attached to the pubic bone, the testis was found. It was somewhat atrophied, being about two-thirds normal size. The internal ring was rather small and did not permit of the return of the testis into the abdominal cavity. There was still a third loculus of the sac communicating with the external and internal loculi and occupying the upper part of the scrotum. (Fig. 6.) This was empty. A portion of omentum, about 3 in. long, about the size of the little finger occupied the inner sac and at its distal end was adherent to the testis. This was removed. The peritoneum was tied off well above the internal ring and sufficient left to make a perfect covering for the testis. The cord was thoroughly freed and the testis brought into the lower part of the scrotum without much tension. The wound was closed by the modified Bassini method, without transplanting the cord.

The inguinoperitoneal variety of hernia (Figs. 7 and 8) has been regarded as an extremely rare type. Moschcowitz (Med. Rec. Vol. LXIII, p. 62, 1903) in reporting a case, stated that only 17 were recorded in the literature.

This type of hernia has already been described by Macready and Küster, and up to recently, very few cases have been reported. That the condition is much more common than has been recognized, is shown by the statistics at the Hospital for Ruptured and Crippled, as well as by my own cases operated upon elsewhere. Personally I have operated upon 25 cases, 10 adults and 15 children. The adults were between 16 and 33 years of age; the children between 5 and 13 years. In all but two cases the testis was either found in the superficial sac resting on the aponeurosis of the external oblique, or it could be made to enter this sac on coughing. In 2 cases, already referred to, the testis had evidently never occupied the external sac (vide Case X).

This type of ectopia I believe to be due to the fact that the vaginal process of the peritoneum has, for some unknown reason been turned upward upon the external oblique instead of taking its normal course into the scrotum.

The treatment of this variety of maldescended testis is extremely satisfactory, for the reason that in most cases the cord is sufficiently long to enable the operator to bring the testis into the scrotum with little or no tension.

CASE XII.—*Unusual type of abdominal ectopia* (see Fig. 9). The patient, aged 17 years, with double undescended testis, was operated on April 18, 1908, at the General Memorial Hospital. On palpation it was thought that an atrophied testis could be felt on the right side, but operation showed an empty vaginal process extending into the scrotum. The bottom of this process was thickened into folds which gave the feeling of an atrophied testis. On the outside of the vaginal process or sac, posteriorly, exactly corresponding to the cord and its vessels in the normal condition, there were a number of vessels, arteries and veins which made up a false cord. These vessels became lost at the bottom of the sac. The testis itself, fully developed, was found in the abdominal cavity, was brought out and by carefully freeing the peritoneal and muscular bands was brought into the bottom of the scrotum.

#### ANALYSIS OF CASES.

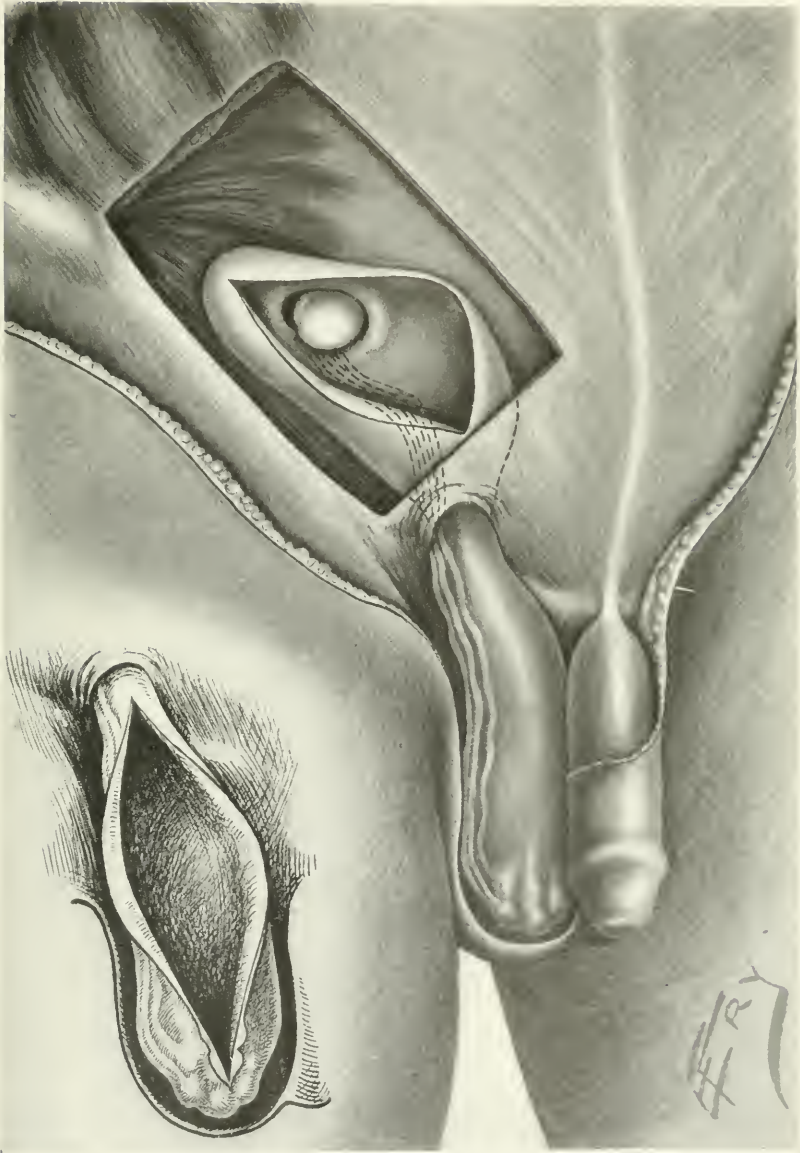
This series of cases comprises 128 operations. Of these 25 represented an ectopia of the inguinoperineal type, with the testis and sac resting upon the aponeurosis of the external oblique. There were 9 cases of the inguinoperineal type, the sac and testis occupied the perineal region.

There has been no recurrence of the hernia in a single only two cases was the testis sacrificed. In both the patients were adults and in one a small atrophied testis was found in the bottom of the sac of a very large inguinoperineal hernia. The other case was one of abdominal ectopia, in which the testis could not be brought outside of the external ring.

There has been but one recurrence of the hernia. Seventy-two cases have been traced from 1 to 15 years with the following results: 52 children were traced from 1 to 15 years, 17 less than one year, 15 not traced; of 44 adults, 19 were traced 1 to 10 years, 4 traced less than 1 year, 21 not traced.

*Results in Adults.*—Of 19 adults examined from 1 to 10 years after operation the testis was found in good position in

FIG. 9.



CASE XII. Abdominal ectopia with false cord extending to the bottom of the scrotum, where it ended.



the scrotum in 8 cases and at the external ring or not stated in the others.

One case deserves special mention, inasmuch as it shows the probable influence of the operation upon epilepsy:

The patient, aged 25 years, was operated upon 5 years ago, for right undescended testis of the inguinal type. The testis was brought into the scrotum and has remained in good position ever since. At the time of the operation he stated that he had been subject since childhood to epileptiform seizures, the attacks occurring frequently, often within 1 to 2 weeks. In a letter received January, 1908, he states that he has never had a single attack since the time of the operation. The patient was presented before the New York Surgical Society at the time the paper was read.

*Results in Children.*—Testis in scrotum in 11 patients; testis outside of external ring in 15 patients and in canal or not felt in 4. The following cases illustrate the results in some of the patients traced for a considerable period of time:

CASE 1, aged 13 years at the time of operation. Examination 13 years later, shows the testis atrophied and resting just outside of the external ring.

CASE 2, aged 13 years at the time of operation. Letter 13 years later, states the testis is normal and in the scrotum. Patient is married and has one child.

CASE 3, aged 8 years at the time of operation. Examination 4 years later shows testis atrophied, just outside the external ring.

CASE 4, aged 5 years; inguinoperineal type operation. Testis in scrotum 8 years after operation.

CASE 5, aged 6 years at the time of operation. Testis just outside the external ring, 7 years later; no atrophy.

CASE 6, aged 5 years at the time of operation. Testis just outside the external ring, 5 years later.

CASE 7, aged 9 years at the time of operation. Testis in scrotum, full size, 9 years later.

CASE 8, aged 12 years at the time of operation. Testis fully descended; examination 7 years later.

CASE 9, aged 10 years at the time of operation. Testis in normal position; no atrophy; examination 5 years later.

CASE 10, aged 13 years at the time of operation. Double, undescended testis, superficial inguinal kind. Operation, 1905. Examination 2 years later shows both testes of normal size, in the upper part of the scrotum.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—(A) SECTION OF CHILDREN.

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
1	V. S. ....	13	Right	Inguinal	Feb., '93	Testis brought into scrotum. Anchored by cat-gut suture	Bassini	Primary union	Examination 13 years later shows atrophied testis just outside external ring. Hernia cured.
2	G. R. ....	8	Left	Inguinal	1, 18, '93	Testis brought into scrotum. Anchored by cat-gut suture	Bassini	Primary union	Examination 4½ years later shows testis atrophied outside external ring. Traced only 4 months.
3	J. O. C. ....	9	Left	Inguinal	6, 12, '94	Testis brought into scrotum. Anchored by cat-gut suture	Bassini	Primary union	Examination 13 years later shows testis normal. Patient married; has one child.
4	M. C. ....	12	Right	Inguinal	1, 11, '95	Testis brought into scrotum. Anchored by cat-gut suture	Bassini	Primary union	Traced 8 years after operation. Normal.
5	M. H. ....	5	Left	Inguino-petineal	11, 15, '95	Testis transplanted to length scrotum. Cord normal	Bassini	Primary union	Examination 7 years later. Testis outside external ring; not atrophied.
6	G. G. ....	6	Right	Inguinal	3, 27, '96	Testis brought outside external ring. Could not be made to reach scrotum	Bassini	Primary union	1 year later. Well.
7	T. W. ....	10	Left	Inguinal	3, 27, '96	Testis brought into upper scrotum	Bassini	Primary union	Testis just outside external ring 5 years later.
8	D. M. ....	9	Right	Inguinal	7, 31, '96	Testis atrophied. Placed in upper scrotum	Cord not transplanted (modified Bassini)	Primary union	Testis could not be felt 6 months later.
9	R. B. ....	9	Left	Inguinal	5, 21, '97	Testis brought into sac	Bassini	Primary union	Well 7 years later.
10	H. C. ....	14	Left	Inguinal	7, 30, '97	Testis brought outside external ring	Bassini	Primary union	Traced 1 year.
11	M. G. ....	7	Left	Inguinal	10, 29, '97	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 years.
12	J. M. ....	9	Left	Inguinal	6, 17, '98	Testis brought into scrotum	Bassini	Primary union	Traced 1 year.
13	W. T. ....	9	Left	Inguino-superficial	9, 2, '98	Testis brought into scrotum	Bassini	Primary union	Traced 2 years.
14	O. S. ....	11	Left	Inguinal	10, 7, '98	Testis brought beyond external ring	Bassini	Primary union	

15	J. M. ....	5	Right	Inguinal	10, 14, '98	Testis brought beyond external ring	Bassini	Primary union	Traced 7 years. Testis atrophied just outside external ring.
16	H. M. ....	9	Right	Inguinal	11, 4, '98	Testis brought beyond external ring	Bassini	Primary union	Traced 8 years. Testis in bottom of scrotum same size as other.
17	S. P. ....	7	Right	Inguinal	7, 21, '99	Testis brought beyond external ring	Bassini	Primary union	Traced 8 years. Testis atrophied outside external ring.
18	W. A. ....	11	Left	Inguinal	8, 4, '99	Testis brought beyond external ring	Bassini	Primary union	Traced 4 years. Testis upper scrotum normal size.
19	W. W. ....	11	Right	Inguinal	3, 30, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 6 years. Testis just outside external ring.
20	A. S. ....	4	Right	Inguinal	5, 18, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 5 years.
21	I. G. ....	12	Right	Inguinal	7, 13, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 7 years; fully descended normal testis.
22	J. H. ....	10	Right	Inguinal	8, 3, '00	Testis brought into upper scrotum	Bassini	Primary union	Traced 8 years. Testis outside external ring size of hickory nut.
23	L. H. ....	9	Right	Inguinal	8, 10, '00	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
24	B. C. ....	7	Left	Inguinal	9, 14, '00	Testis brought into upper scrotum	Bassini	Primary union	Traced 7½ years. Testis external ring.
25	H. W. ....	11	Left	Inguinal	6, 7, '01	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
26	J. S. ....	10	Right	Inguinal	1, 3, '02	Testis brought into upper scrotum	Bassini	Primary union	Traced 5 years. Testis in good position.
27	A. W. ....	12	Left	Inguinal	1898	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
28	J. L. ....	8	Left	Inguino-superficial	2, 14, '02	Testis brought into upper scrotum	Bassini	Primary union	Traced 10 years. Testis in canal.
29-30	O. H. ....	10	D'ble	Double inguino-superficial	3, 20, '02	Both testes brought into lower scrotum. Cord normal length.	Bassini	Primary union	Traced 5 years. Testis in good position.
31	M. V. H. ....	...	Right	Inguinal	6, 27, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
32	J. B. ....	8	Right	Inguino-superficial	9, 5, '02	Testis brought into upper scrotum	Bassini	Primary union	Traced 5½ years. Well.
33	R. K. ....	10	Left	Inguinal	9, 5, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
34	A. H. ....	5	Right	Inguinal	1, 9, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
35	L. K. ....	5	Left	Inguinal	1, 23, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 8 months.
36	J. F. ....	9	Right	Inguinal	4, 10, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—SECTION OF CHILDREN. *Continued.*

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
37	J. S. ....	7	Left	Inguinal (interstitial sac)	4, '20, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 years. Testis not felt.
38	M. L. ....	8	Left	Inguinal	5, '1, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
39-40	J. C. ....	11	D'ble	Inguinal	5, '1, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 months.
41	R. S. ....	9	Right	Inguinal	5, '20, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 years.
42-43	W. T. ....	12	D'ble	Inguinal	10, '30, '03	Testis brought into upper scrotum	Cord not transplanted on either side	Primary union	Traced 4 years.
44	H. W. ....	11	Left	.....	10, '30, '03	Testis brought into lower scrotum without tension	Cord not transplanted	Primary union	Traced 4 years.
45	O. H. ....	12	Right	Inguino-superficial (Traumatic kick in groin)	1, '22, '04	Testis placed in bottom of scrotum	Bassini	Primary union	Traced 9 months.
46	J. B. ....	7	Left	Inguino-superficial	2, '5, '04	Testis placed in bottom of scrotum	Bassini	Primary union	Traced 4 years. Testis not felt.
47-48	T. M. ....	7	D'ble	Inguinal	2, '19, '04	Testes placed in scrotum	Bassini. Left cord not transplanted	Primary union	Hernia cured; both testes just outside external ring April, 8, 1908; 4 years testes about one-half normal size. Not traced.
49	H. M. ....	14	Left	Inguinal	4, '15, '04	Testis brought into upper scrotum	Bassini	Primary union	Traced 2 years.
50	L. B. ....	10	Right	Inguinal	3-25, '04	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
51	C. S. ....	6	Left	Inguinal	4, '22, '04	Testis brought into lower scrotum	Bassini	Primary union	Traced 1 year.
52	M. M. ....	8	Right	Inguinal (Putré) Testes join outside internal ring	9, '16, '04	Testis brought into upper scrotum	Cord not transplanted	Primary union	Testis at external ring few months after operation. Traced 3 years; good position. Not traced.
53	S. L. ....	13	Right	Inguinal	11, '4, '04	Testis brought into upper scrotum	Bassini	Primary union	Traced 1 year; both testes still in upper scrotum, not atrophied.
54	A. S. ....	12	Left	Inguinal	1, '13, '05	Testis placed in scrotum	Bassini	Primary union	
55	H. A. ....	8	Right	Inguino-superficial	2, '17, '05	Testis placed in scrotum	Cord not transplanted	Primary union	
56-57	H. S. ....	12	D'ble	.....	5, '15, '04	Testes brought into scrotum	Cord not transplanted either side	Primary union	

58	P. A. ....	4	Right	Inguinal	3, 17, '05	Testis brought into scrotum	Cord not planted	Primary union	Traced 2 years.
59	J. F. ....	6	Right	Inguinal. Testis at internal ring	4, 14, '05	Testis brought into scrotum	Cord not planted	Primary union	Traced 2 years.
60	G. L. ....	8	Left	Inguinal	9, 22, '05	Testis brought into scrotum	Bassini	Primary union	Not traced.
61-62	E. S. C. ....	13	D'ble	Inguino-superficial	11, 23, '05	Both testes placed in bottom of scrotum	Bassini, both sides	Primary union	Traced 2 years; both testicles outside external ring, no atrophy.
63	H. B. ....	12	Right	Inguinal	1, 26, '06	Both testes placed in bottom of scrotum	Cord not planted	Suppuration	Traced 2 years. Testis in bottom of scrotum.
64	F. W. ....	6	Left	Inguinal	1, 20, '06	Both testes placed in bottom of scrotum	Cord not planted	Primary union	Died of scarlet fever while in hospital.
65	E. S. ....	9	Right	Inguinal	2, 2, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 1½ years.
66	W. W. ....	11	Left	Inguinal	2, 2, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 6 months.
67	S. S. ....	7	Left	Inguinal	2, 16, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Not traced.
68	A. L. ....	6	Right	Inguinal	3, 16, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 2 years. Testis outside external ring, April 2, 1908.
69	G. M. ....	11	Right	Inguino-superficial	3, 30, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 2 years. Testis just outside external ring.
70	W. W. ....	4	Right	Inguino-superficial	4, 27, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 1 year. Testis not felt.
71	R. L. ....	11	Right	Inguino-superficial	3, 15, '07	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 1 year. Testis at external ring.
72	A. B. ....	13	Right	Inguino-superficial	3, 15, '07	Testis brought into middle of scrotum	Cord not planted	Primary union	Traced 1 year.
73	E. H. ....	12	Right	Inguino-superficial	3, 22, '07	Testis brought to bottom of scrotum	Cord not planted	Primary union	Not traced.
74	H. G. ....	5	Right	Inguinal	4, 19, '07	Testis brought into scrotum	Cord not planted	Primary union	Traced 1 year.
75	P. Z. ....	10	Right	Inguino-superficial	2, 15, '07	Testis brought into upper scrotum	Cord not planted	Primary union	Traced 1 year.
76	F. P. ....	12	Left	Inguino-superficial, also femoral hernia	5, 3, '07	Testis brought into bottom of scrotum	Cord not planted	Primary union	Traced 9 months.
77	V. B. ....	7	Right	Inguino-superficial	5, 24, '07	Sac rested on external oblique up to a anterior superior spine. Testis, ½ normal size, placed in scrotum	Cord not planted	Primary union	Not traced.
78	F. E. ....	4	Right	Inguinal	5, 24, '07	Testis brought into bottom of scrotum	Cord not planted	Primary union	Traced 9 months. Testis in upper scrotum.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—SECTION OF CHILDREN.—*Continued.*

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
79	G. M. ....	5	Left	Inguinal	6, 10, '07	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Well 10 months.
80	A. B. ....	7	Right	Inguinal	6, 10, '07	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Traced only 2 months.
81	M. M. ....	6	Left	Inguinal	1, 3, '08	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Well at present; 3 months.
82	J. B. ....	7m.	Left	Inguino-perineal. Irreducible	1, 10, '08	Testis transplanted from perineum into bottom scrotum. (Cong. Hernia sac.)	Cord not transplanted	Primary union	Well at present; 4 months.
83	G. N. ....	6	Right	Inguinal	1, 24, '08	Testis placed in upper scrotum	Cord not transplanted	Primary union	Well at present.
84	L. R. ....	5	Left	Inguino-superficial	2, 21, '08	Testis placed in scrotum	Cord not transplanted	Primary union	Well at present.

TABLE OF CASES OF UNDESCENDED OR MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—(B) ADULTS.

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
85	M. G. ....	25	Right	Canal	1900	Testis brought into scrotum	C. N. T.	Primary union	Well 1 year.
86	J. R. ....	19	Right	Canal	1900	Testis brought into scrotum	C. N. T.	Primary union	Well 1 year.
87	Long .....	15	Right	Canal	1900	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
88	W. G. ....	17	Right	Inguino-perineal	1901	Testis transplanted into scrotum	C. N. T.	Primary union	Well 6 years. Testis in lower scrotum, no atrophy.
89	J. T. ....	20	Left	Canal	1893	Testis brought into scrotum	C. N. T.	Primary union	Well 4 years. Testis external ring.
90	L. J. ....	17	Left	Canal	1893	Testis brought into scrotum	C. N. T.	Primary union	Well 6 years.

91	L. N. ....	30	Left	Inguino-superficial, external ring bilocular sac. Very long	1898	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
92	J. M. ....	27	Right	Inguino-perineal	1895	Testis atrophied. Removed	C. N. T.	Primary union	Well 1 year.
93	R. ....	17	Left	Inguinal	3, 15, '06	Testis brought into upper scrotum	C. N. T.	Primary union	Well 5 years. Testis in scrotum; no further attack of epididymitis.
94	C. D. ....	30	Right	Canal (epilepsy)	1903	Testis brought into scrotum	C. N. T.	Primary union	1 year later testis outside external ring. Not traced.
95	H. W. ....	30	Right	Inguino-superficial	1902	Testis brought into scrotum	C. N. T.	Primary union	Well 1 year.
96	W. K. ....	23	Left	Abdominal retention	1903	Testis brought to upper scrotum	C. N. T.	Primary union	1 year later both testes in scrotum.
97	C. S. ....	28	Right	.....	1902	Testis brought into scrotum	C. N. T.	Primary union	Testis in scrotum 5 years later.
98	G. D. ....	17	Double	Canal, both sides	1902	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
99	T. E. ....	40	Right	Inguino-perineal	1902	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
100	T. E. ....	40	Right	Inguino-perineal	1902	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
101	S. S. ....	20	Left	Inguino-superficial	.....	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
102	T. S. ....	18	Right	Inguino-superficial	.....	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
103	J. I. ....	33	.....	Inguino-superficial	1903	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
104	C. D. ....	29	Right	Inguino-perineal	1907	Testis transplanted into scrotum	C. N. T.	Primary union	Testis soon got back into perineum; second operation October, 1907, sutured in scrotum. Perfect result April, 1908. Not traced.
105	W. C. ....	16	Right	Inguino-perineal	1896	Testis transplanted into scrotum	C. N. T.	Primary union	Hernia recurred 1 year later.
106	A. S. ....	35	Right	Inguino-perineal	1896	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
107	H. L. ....	20	Left	Inguino-superficial	1905	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
108	T. G. ....	45	Left	Abdominal	5, 23, '06	Testis atrophied; removed. Could be brought only into canal.	C. N. T.	Primary union	Well 2 years later.
109	E. M. ....	25	Right	Inguino-superficial	1, 22, '06	Testis atrophied; removed. Could be brought only into canal.	C. N. T.	Primary union	Not traced.
110	D. R. ....	38	Right	Canal	July, '06	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
111	G. C. ....	22	Right	Inguino-superficial	11, 14, '06	Testis brought into scrotum	C. N. T.	Primary union	Not traced.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—ADULTS.—*Continued.*

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
112	S. G. ....	22	Left	External ring	4, 10, '07	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
113	M. E. ....	16	Left	Inguino-superficial. Bilocular sac	Apr., '07	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
114	O. R. ....	30	Right	Canal	Feb., '06	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
115	H. W. ....	20	Right	Inguinal	Feb., '06	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
116	G. T. ....	14	Left	Inguinal	Aug., '04	Testis transplanted into scrotum	C. N. T.	Primary union	Well 3½ years. Testis increasing in size. Hernia cured.
117	B. A. ....	23	D'ble	Left, inguinal. Right abdominal	10, 20, '04	Left operation. (Dr. Downes.) Right testis in abdomen and operated on	C. N. T.	Primary union	Not traced.
118-119	F. R. ....	16	D'ble	Inguinal	Nov., '04	Testis brought into scrotum. (O. Dr. Downes)	C. N. T.	Primary union	Right testis in scrotum two years later; left external ring.
120	S. M. ....	21	Left	Inguinal	Feb., '05	Testis brought into scrotum	C. N. T.	Primary union	Testis in middle scrotum March 27, 1908, nearly 3 years.
121	A. B. ....	41	Right	Superficialinguinal	5, 4, '05	Testis brought into scrotum	C. N. T.	Primary union	March 28, 1908, latter states slight relapse; no hernia.
122	L. F. ....	38	Left	Superficialinguinal	Oct., '05	Testis brought into scrotum	C. N. T.	Primary union	Testis in bottom of scrotum; no atrophy 2½ years later.
123	F. C. ....	22	Right	Superficialinguinal	11, 22, '05	Testis brought into scrotum	C. N. T.	Primary union	No atrophy of testis.
124	J. C. ....	16	Right	Canal	12, 6, '05	Testis brought into scrotum	C. N. T.	Primary union	Well at present. Testis upper scrotum.
125	S. ....	20	Right	Inguino-superficial	7, 19, '07	Testis brought into scrotum	C. N. T.	Primary union	Testis in scrotum.
126	A. H. ....	24	Right	Inguino-superficial and interstitial bilocular sac	3, 19, '08	Testis brought into scrotum	C. N. T.	Primary union	Testis in scrotum.
127	H. W. ....	17	D'ble	Abdominal	4, 16, '08	Right testis brought into upper scrotum. No operation on left side	C. N. T.	Primary union	Testis in scrotum.
128	J. E. ....	22	Right	Abdominal	4, 16, '08	Right testis brought into upper scrotum	C. N. T.	Primary union	Testis in scrotum.

## CONCLUSIONS.

From my own observations as well as from a careful study of the reports of other surgeons, I believe the following conclusions are justified:

1. The undescended testis is almost invariably of little or no functional value. It often gives rise to considerable pain and is more subject to inflammatory attacks than the normally descended organ and, possibly (though this is by no means proven), is more subject to malignant changes.

2. The undescended testis should never be sacrificed in children and very rarely in adults, it having been proven possible to effect a radical cure of the hernia quite as well without the removal of the organ. In childhood the testis, even if it never attains any functional value, is nevertheless of value in developing the male characteristics of the child as well as in promoting his general health. In the adult, it should be retained for its influence upon the mentality of the subject, if for no other reason.

3. Operation should seldom be performed under the age of 8 to 12 years, unless the accompanying hernia demands such operative intervention, for the reason that in a considerable number of cases the testis descends spontaneously on the approach of puberty, unless double.

Abdominal ectopia unless double had best be left untreated, inasmuch as operation is difficult and by no means free from risk.

4. As to methods of operation, the main principles of any operation likely to yield satisfactory results, must be: Free opening of the inguinal canal, which is secured by Bassini's incision; thorough freeing of the testis from any adhesions or peritoneal bands, even with the sacrifice of some of the veins, if necessary; bringing the testicle into the scrotum; suture of the canal without transplantation of the cord.

The present tendency in favor of giving up all forms of suturing the testis, either to the scrotum, the other testis or the thigh is, I believe, fully justified.

Inasmuch as very satisfactory results may be obtained without cutting away all the structures of the cord except the

vas and its vessels, I believe this more radical step very seldom indicated.

5. No case of double undescended testis should be allowed to reach the age of puberty.

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## OPERATION FOR UNDESCENDED TESTICLE.\*

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FROM a brief scrutiny of the literature it would seem that there is thought to be a small chance of help for non-descended testicle except by castration. Erichsen<sup>1</sup> says, "Any attempt to bring the testicle down into the scrotum would be ineffectual." He further adds, that if it is in some position in the canal where injury is likely to occur, it is preferable to remove it. Treves<sup>2</sup> says the undescended testis should be stitched to the bottom of the scrotum, and under certain circumstances should be removed. Pick<sup>3</sup> thinks one should consider the feasibility of transplanting the gland and fixing it in the scrotum. If this cannot be done he recommends its removal. Bryant,<sup>4</sup> after describing a fascinating method, adds, "The successful attainment of these steps is not easy, nor finally as satisfactory as might appear from the description." Stonham<sup>5</sup> describes an operation where he makes a long incision and transplants the testicle, suturing the tunica albuginea to the scrotum. Kocher<sup>6</sup> recommends fastening the spermatic cord at its entrance into the scrotum, as well as fastening the testis to the bottom of the scrotum. Corner<sup>7</sup> says that replacement in the abdomen is indicated in by far the majority of cases. Bevan<sup>8</sup> describes an elaborate operation which necessitates opening the peritoneal cavity. Von Braumann<sup>9</sup> advises strongly against removal.

From the foregoing remarks it will readily be seen that there seems little to choose from in the various methods recommended. Some other writers advise massage and manipula-

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\* Read at the Surgical Section of the Academy of Medicine of Toronto.

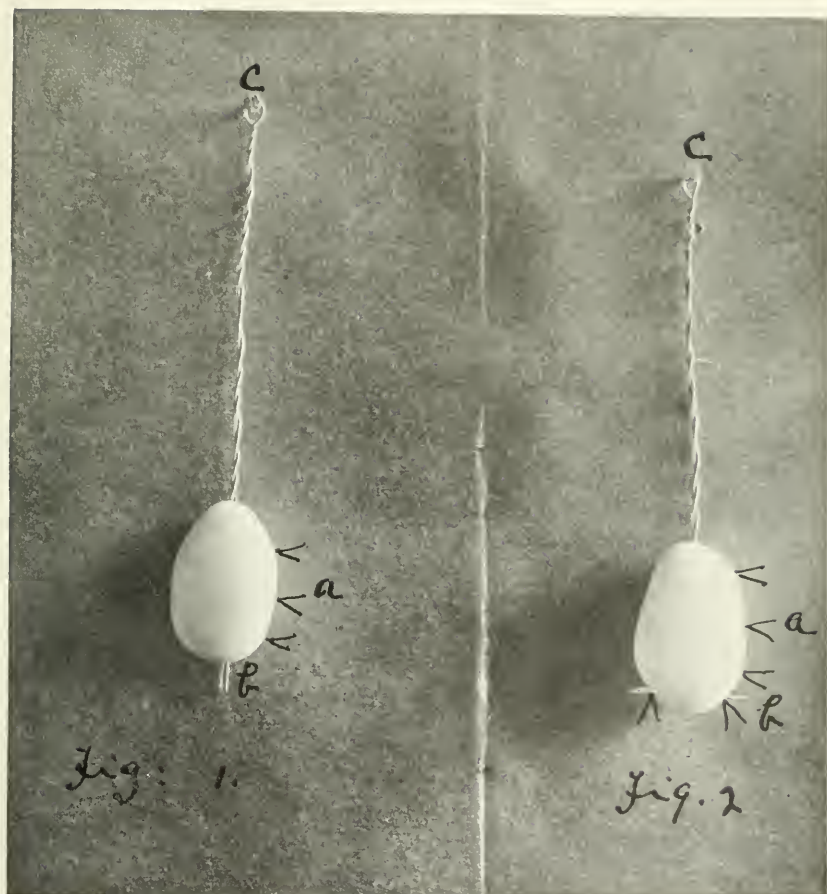
tion, and no doubt if begun early, and carried out persistently, some of the cases might be cured. Others have recommended a U-shaped truss to fit just above the testicle and force it down, while yet others have described various mechanical devices with the same object. Such methods have only to be mentioned to be condemned.

It would seem then that surgeons are divided between,—suturing to the bottom of the scrotum, transplanting within the abdomen, and removal. This latter cannot be too strongly condemned, for no matter how atrophic a testis may appear, one has no means of knowing the possibilities of development under suitable conditions.

When it comes to the question of operation, no doubt there are some cases in which, with the testis at or near the internal abdominal ring, it may be wise to transplant the gland within the abdomen, to remove it from the possibility of injury. But, when the testis is in the inguinal canal, near the external ring, or is outside the ring, the following operation which I have devised and carried out successfully, appeals to me as a reasonable means of securing a desirable result.

An incision about one inch long is made over the external abdominal ring, the testicle is secured and brought out of the wound. The finger is then carried down into the scrotum, and, by means of blunt dissection, the scrotal sac is stretched to make a suitable resting-place for the testis. The cord is then dissected free of its coverings, and if necessary to secure increased length, the cremasteric and spermatic arteries may be sacrificed, but the artery to the vas must not be interfered with. It is well now to see that the testicle can be easily replaced in the pocket provided without tension upon the cord. It is again taken out and sutured by means of chromic catgut, No. 0, through the tunica albuginea to the loops of a piece of plaited silver wire, two or three inches long, as may be required (Fig. 1 (a)). The wire ends at (b) are then pushed against the bottom of the scrotum and cut upon to permit of their being pushed through. The free ends are then bent, as in Fig. 2 (b). To make assurance doubly sure two horsehair sutures are

FIGS. 1 AND 2.



Showing testis secured to loop of silver wire to act as splint for retaining it in scrotum.



passed up through the tiny opening in the scrotum, from which the wire projects, one on each side of the wire shaft, to catch the tunica albuginea. They are brought out again and tied over the projecting wire ends (Fig. 3 (b)). The loop of the wire shaft at (c) is now sutured by means of 10-day chromic catgut No. 1 to the periosteum over the os pubis (Fig. 3 (c)). The testicle is now securely placed in the scrotum and is maintained there by means of a silver wire splint. The operation

FIG. 3.

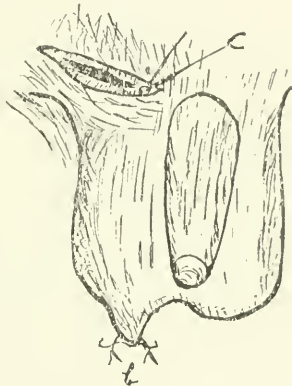


Diagram to show splint in position. (C) Catgut that secures loop of splint to periosteum over the os pubis.

is completed by introducing through the skin, at one end of the incision, a horsehair suture which travels sub-cutaneously, taking up the spermatic fascia and divided cremasteric muscle over the cord. It is brought out again through the skin, at the opposite end, carried over the top of a small roll of gauze, and continued along as an uninterrupted stitch, to bring the skin edges into apposition. The two free ends are tied over another small roll of gauze. The wound is carefully dressed with plenty of pads and a double spica applied. On the twelfth day the dressing is removed, and the cutaneous horsehair, snipped at one end, is then easily withdrawn. The two horsehair stitches at (b) are now cut and removed, when the end of the wire is grasped with a pair of forceps and the wire splint removed.

The result has been most satisfactory. Both testicles are on a level, both are now of equal size, though the non-descended one was small at the time of operation. There was no pain or discomfort during healing, and I was surprised at the ease with which the wire splint came away.

This operation holds out some hope for the correction of an abnormality that heretofore has not been amenable to treatment, other than such as will lead to a greater deformity, even though it does succeed in relieving pain and discomfort.

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## THE RADICAL TREATMENT OF CARCINOMA OF THE BLADDER.

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THE percentage of ultimate cures effected by the various radical operations for carcinoma of the urinary bladder is very small and does not bear favorable comparison with that which is achieved in the radical treatment of carcinoma of other organs. These bad results are partly owing to the complicated problems we are called upon to meet in dealing with malignant neoplasms of this viscus, and partly to the fact that we have neglected to fully appreciate certain facts in the pathology of this disease.

The radical operative cure of a malignant tumor, according to our present conception, demands a wide removal of the primarily diseased tissue and of the secondarily affected lymphatics and glands. When malignant deposits have extended beyond the immediate local glandular apparatus or have appeared in distant organs, the idea of a radical extirpation of the disease can no longer be entertained. It is surprising how these axiomatic principles for the radical cure of malignant tumors are constantly ignored in cases of malignant growths of the urinary bladder. Thus it has been, and still is, the common practice to entirely ignore the lymphatics and glands in the radical operation for cancer of this viscus, owing possibly to the idea that these structures are usually not affected. This supposition, however, is entirely erroneous. In the very early stages of the malignant growth, when the neoplasm is confined to the mucosa and is not ulcerated, the lymphatics and glands usually show no malignant changes, but as soon as the tumor invades and infiltrates the muscular coats of the bladder the spread to the lymphatics and glands

takes place, and no operation can be a radical one that does not include a wide removal of these latter structures. In 56 cases of infiltrating cancer of the bladder collected by Guyon, glandular enlargement was positively recorded in 15, and in the other 41 no mention was made as to whether the glands were or were not involved.

In a previous communication the writer called attention to the necessity of a wide removal of all infected sacral and iliac glands and described the technic for their extirpation. (*ANNALS OF SURGERY*, 1904, vol. 40, 382.)

Another consideration of vast importance has only recently been called to our attention by Dr. F. Mandlebaum in his admirable study of "New Growths of the Bladder," published in *Surgery and Gynecology*, V, 315, 1907. In 1870, Klebs (*Handb. d. Path. Anat.*) announced his view that carcinomata of the bladder are always secondary to primary deposits in the prostate, rectum, or uterus, and that in women at least a primary tumor of the bladder cannot be cancerous. This opinion was combatted by the school of Necker and defended again by Motz and Monfort. The importance of this point is very evident. If Klebs is right, then in the male subject the removal of the prostate is essential to every radical operation for bladder cancer. Mandlebaum carefully studied this particular question. He found that the papillary and the flat or squamous-celled carcinomata do occur as primary tumors in the bladder, but that the fibro- or scirrhus-carcinomata, and the adenocarcinomata are very often, if not always, secondary to primary tumors of the prostate, uterus, or rectum. Thus he had in his collection of cases five of fibro- or scirrhus-carcinomata. In these patients a clinical diagnosis of primary malignant tumor of the bladder was made, because a careful physical examination of the prostate and rectum had failed to reveal any evidence of malignant trouble in these organs. Yet a close study of the extirpated tumors and a postmortem examination in two of the patients revealed the fact that in four of the cases the neoplasm was primary in the prostate and secondary in the bladder. He

made a similar observation in two cases of apparent primary adenocarcinoma. In these two patients a postmortem examination showed that the prostate was the primary focus of disease, though no evidence thereof was furnished by a careful physical examination during life.

If the conclusions reached by Dr. Mandlebaum are confirmed by further investigation, their bearing upon the surgical aspects of vesical carcinomata will be very great. They teach us first of all not to rely upon the evidence furnished by physical examination in forming our opinion as to the existence of a malignant tumor in the prostate. Secondly, they demonstrate the great importance of knowing the exact histological character of every malignant tumor of the bladder before proceeding to its radical removal; for of what use is it to extirpate a part or the whole of the bladder if thereby is removed only a secondary deposit, while the primary growth in the prostate, uterus, or rectum is left unmolested? If the adeno- and scirrhus-carcinomata are found to be always secondary tumors, then the radical operation for their cure must include a wide removal of the primarily diseased part. In the light of Dr. Mandlebaum's investigations, the writer does not doubt that many recurrences after radical operations for vesical cancer are due to the fact that an unrecognized primary focus of malignant disease in the prostate, uterus, or rectum was left behind at the time of the operation, and he is convinced that attention to the facts brought out by Dr. Mandlebaum will better our percentages of ultimate cures of this malady.

With these preliminary remarks on the pathology of vesical carcinomata and the bearing they have upon the extent of operative procedures undertaken for their radical cure, we come to consider how best to deal with the neoplasin; and here the operator must give his attention not only how to widely remove the tumor, but also how to restore or substitute for the function of a urinary reservoir which the bladder serves.

This latter fact complicates the problem very much and has been and still is the subject of much discussion. If the

reservoir function of the bladder could be entirely dispensed with or satisfactorily and safely replaced or substituted for in some manner, a vesical carcinoma could be dealt with much as is a carcinoma of the gall-bladder, namely, by complete excision of the affected organ; but thus far all our experience has not succeeded in demonstrating how to so safely replace or substitute for this urinary function of the bladder. The use of the rectum, vagina, or partly excluded loop of intestine, *e.g.*, the sigmoid flexure or small intestine, as a substitute for the bladder, has been mostly abandoned because of the danger entailed thereby of an infection from these viscera ascending the ureters to the kidneys, with consequent pyelonephritis and death. Similarly, the doing away altogether with a urinary reservoir by implanting the ureters onto the skin of the abdomen or loin, or by direct drainage of the kidney-pelvis through the loin (double nephrostomy) exposes the kidneys to the same dangers of infection, and places additional worry, annoyance, and discomfort upon the patient in the attention and care that must be expended upon the toilet of the urinary fistulæ.

Our ineffectual efforts to provide a satisfactory substitute for the reservoir function of the bladder or to safely and conveniently do away with it altogether make it very desirable in the radical operations for vesical cancer to preserve enough of the bladder to act as a urinary reservoir, provided this is consistent with the requirements of a radical extirpation of the disease. This desideratum at once brings up the following questions:

1. Is it possible to effect a lasting and permanent cure of a vesical carcinoma by a partial resection of its wall, or is it necessary in every case to completely excise the viscus?
2. In case partial resection is consistent with the requirements of a radical extirpation, how much bladder wall must be left in order to make a satisfactory urinary reservoir?

As regards the first of these questions,—*viz.*, is it possible to effect a lasting cure of a carcinoma of the bladder by a partial resection of its wall, or is it necessary in every case

to completely excise the viscus?—Rafin, in his masterly monograph on Tumors of the Bladder, published in *Compte rendu de l'association française d'urologie* for 1905, gives the results of 96 partial cystectomies for carcinoma. These cases were collected from literature and by personal communication with those in charge of large hospital services. Of these 96 cases, 21 died from the operation, and 25 could not be subsequently traced. Of the remaining 50,

1 was well after 3 years.

1 was well after 3 years and 4 months.

1 was well after 4 years.

1 was well after 5 years.

1 was well after 6 years.

16 were well at periods ranging from 6 months to 2 years.

Twenty-one of the fifty then were living without recurrence at periods varying from six months to six years, and five had passed the three-year limit. In view of these reports there cannot be any doubt of the possibility of radical cure by partial resection of the bladder.

It is true that the immediate mortality of the operation in the cases reported by Rafin is very high—21 + per cent.—and that the number of permanent cures is very small; but the fact is clearly demonstrated that by partial cystectomy a radical cure can be effected, and it is only reasonable to assume that with improved technique the operative mortality will be less, and that with earlier recognition of the disease and attention to the pathological facts already mentioned, the number of permanent cures will be much increased.

Watson, however, from an extended study of the cases reported in literature, takes a different view from that just expressed. He holds that the chief causes for the high mortality attending operations for vesical carcinoma and for their frequent recurrence seem to be in the failure to operate soon enough and radically enough. To quote his emphasized statement: "The very large percentage of recurrence seems to point logically to the necessity of more radical measures in

benign as well as in cases of malignant tumors, if we are to hope for better results. The suggestion I have to make in this report is that total extirpation of the bladder and of the prostate, if it be involved in the pathological process, be done at the outset in all cases of carcinoma that have not extended beyond the above named structures and in which it is believed that there are no metastases; and that the same measure be applied in all cases of benign growths in which recurrence has taken place after a primary operation for their removal."

He goes on to say that ureteral implantation which contributes, as it seems, to the surgical failures, should be abandoned, and *lumbar nephrostomy*, with ligation of the ureters done instead, and at some time previous to the operation for the removal of the tumor, as it seems to offer a much safer and less objectionable way of disposing of the most difficult part of the latter operation.

It is important that we consider in detail these statements of Dr. Watson, which have for their foundation not his own acute clinical observation and personal experience, but merely the records of cases reported in the literature.

In this consideration it is necessary first of all to compare the immediate and late results after partial and complete cystectomy. Rafin collected 30 cases of total excision of the bladder for carcinoma. In 17 of these there was a fatal issue to the operation, *i.e.*, a mortality of 56.5 per cent. Five of the surviving cases could not be traced; in 3 death occurred from kidney complications, 4 months, 13 months, and 5½ years respectively, after operation; and 3 were well 7 months, 15 months, and 5 years respectively, after operation. These results compare most unfavorably with those obtained after partial cystectomy, for in the latter the immediate mortality was much lower—21 out of 96 cases, *i.e.*, 21+ per cent., and the ultimate results were better, inasmuch as 21 out of 50 cases were known to be well and free from recurrence at periods varying from six months to six years after operation.

Of the 17 immediate operative deaths after complete

cystectomy in the series collected by Rafin, 9 were from renal causes, and it is possible that some of these might have been averted by a preliminary lumbar nephrostomy, as suggested by Watson. The latter author is in favor of complete extirpation for two reasons: (1) the dangers of recurrence after partial cystectomy, and (2) the dangers of ascending infection to the kidneys resulting from ureteral implantation into the bowel or vagina or on to the skin of the loin or abdomen. In answer to these objections to partial cystectomies it is to be noted that the percentage of recurrence after total extirpation of the bladder is almost as high as in those who survive the partial extirpation. Of Watson's 25 collected cases of complete extirpation, 11 survived, and of these only 2 were alive and free from recurrence after three years; 1, three years, and 1, eight years, respectively; whereas, of Rafin's 96 cases of partial cystectomy, the 50 that survived and could be traced, included 5 that had safely passed the three-year limit without recurrence.

As regards this question of recurrence, it is the writer's opinion that the dangers thereof are not materially dependent upon whether a complete or partial cystectomy be done, provided, of course, that the disease is widely extirpated; but that they are dependent, as stated in a preceding portion of this paper, first, upon whether all the cancer-infected glands and lymphatics are simultaneously removed with the primary tumor; and, secondly, upon whether, when the primary neoplasm is in the prostate, uterus, or rectum, these affected parts are likewise removed, together with the vesical tumor.

In other words, the writer thinks that where the carcinoma is primary in the bladder and limited to one part thereof, a wide removal of the neoplasm (partial cystectomy), together with all the lymphatics and glands, will afford as sure a protection from recurrence as will a complete extirpation of the organ.

In reference to the proposal that a preliminary bilateral lumbar nephrostomy with ligation of the ureters should replace ureteral implantation into the intestine or vagina, or onto

the skin of the abdomen or loin. Watson urges that the time of operation would be thereby shortened; that liability to kidney infection would be much less; and that the procedure supplies immediate and sufficient drainage from the kidney and is the best means for giving prompt relief to renal retention.

These arguments can apply *prima facie* only to complete extirpation with ureteral implantation into the intestine, or vagina or onto the skin, as against complete extirpation with preliminary lumbar nephrostomy, and not as against partial cystectomy with ureteral reimplantation into the bladder; for in the first place the danger of ascending kidney infection through a ureter that has been reimplanted into a remaining normal part of the bladder is not greater than that after a lumbar nephrostomy. In fact, it would seem, judging from the writer's experience with this latter procedure done for other causes—*i.e.*, persistent hæmaturia, stone, etc., that some infection of the kidney pelvis always results therefrom.

Watson furthermore estimates the mortality resulting from ureteral implantation into the intestine, vagina, or skin, as being much higher than that resulting from direct lumbar nephrostomy. Of this there is no question. But we must not confuse the dangers of ureteral implantation into an infected viscus with the dangers resulting from ureteral reimplantation into the bladder, as is the case when a partial cystectomy is done. According to Watson's own figures, the operation of nephrostomy done for any and all causes is 15 per cent. Surely if we are to accept this figure as pertinent to nephrostomy done as a preliminary procedure to a radical operation for bladder carcinoma, we must acknowledge that for a preliminary step the mortality is inordinately high, and we could scarcely be expected to enter heartily into any proposal that promises so large a percentage of deaths before we even commence a radical cure of the disease itself. As a matter of fact, however, the writer does not believe that a preliminary nephrostomy—when the kidneys are comparatively healthy—

has anything like so high a mortality as 15 per cent., and surely ureteral reimplantation into a healthy part of the bladder, done according to the modern improved technic, as will be later described, is not attended with anything like 15 per cent. of immediate operative deaths.

As to the comparative dangers of infection of the kidney after bilateral nephrostomy and ureteral reimplantation into a healthy bladder, there are no reliable figures or extended clinical experiences upon which we can at present base conclusions. There are instances of late infection of the kidney pelves after lumbar nephrostomy as well as after ureteral reimplantation into the bladder, and only continued trial of the two procedures will demonstrate in which of them the dangers of late kidney infection is the greater.

Watson further dwells on the advantages of lumbar nephrostomy in case the kidneys are already infected. In such cases the good effect of drainage of the kidney pelves cannot be questioned, but surely one cannot contemplate a radical operation for the bladder cancer under such conditions. In patients with this complication, radical operations have no place—only palliative procedures are to be considered in them.

Furthermore, there are serious objections to a general use of lumbar nephrostomy in operation for bladder tumors. The proper care of such urinary fistulæ is possible only by the highly intelligent and cleanly who can be taught the principles of asepsis, and by those who do not have to engage in hard manual toil. In all others the dangers of kidney infection are much greater, and the wearing of an apparatus such as is described by Watson is hardly consistent with the occupation of mechanics or laborers.

Taking into consideration then all the facts: first, that the freedom of recurrence after partial cystectomy is as great as that secured by complete extirpation; secondly, that the immediate operative mortality after partial cystectomy is not half as high as that after entire removal of the bladder; thirdly, that the objections raised by Watson to ureteral implantation into the intestine, vagina or skin do not maintain

to ureteral reimplantation into a remaining healthy portion of the bladder, the writer is forced to the conclusion that when we have to deal with growths limited to a third of the bladder, and especially when their site is on the fundus and lateral walls, *partial cystectomy with reimplantation of the ureter into the remaining portion of the bladder when the ureteral orifice is involved in the disease is by far the operation of choice.*

It must not be inferred, however, that total extirpation has no place in our consideration of the radical cure of this disease, for when the cancer is diffusely spread over the greater part of the bladder, thus forbidding us to save a sufficient portion thereof to form a reservoir for the urine, or when there is a bad cystitis that does not yield immediately to therapeutic measures and which necessarily increases materially the dangers of ascending ureteral infection after reimplantation of the ureters, then complete extirpation is advisable provided the patient is otherwise sound.

The preliminary operation of lumbar nephrostomy would certainly seem to be indicated when complete excision is done.

In reference to the second question that I have proposed in connection with partial cystectomy, viz., how much bladder wall must be left to form a satisfactory reservoir for the urine?—there are no reports in the literature bearing upon this point. The writer in one case removed slightly more than one-half of the bladder, and the remaining portion performed the function of a reservoir very well. The patient could hold his urine easily for three hours; he had to get up twice at night to urinate, and was very comfortable. In his three other cases about one-third of the bladder wall was removed. In two of these latter that survived the operation the remaining portion of the bladder functionated excellently as a reservoir, the patients being able to hold their urine almost as well as in their healthy state. In the light of these experiences the writer would say that one should be able to remove fully one-half of the bladder without materially interfering with the function of this organ, and that the removal of a third

of the viscus does not have any appreciable effect upon the function of the remaining portion.

A few words in reference to the technic of partial cystectomy as done by the writer and described by him in *ANNALS OF SURGERY*, 1904, vol. 40. A median incision is made above the symphysis or a lateral one at the outer margin of either rectus muscle, depending upon the location of the tumor in the bladder as previously determined by the cystoscope. This incision is deepened down to the peritoneum, which latter is then stripped back from the pelvis and from the bladder. If the tumor occupies the peritoneal surface of the bladder the affected part of this membrane will likewise have to be removed. The peritoneal cavity is therefore best opened in such cases at once and the intestines protected with warm pads. With the patient in Trendelenburg's position search is made for glandular enlargement along the course of the internal iliac artery and in the concavity of the sacrum. When such glands are present, they are carefully removed, together with the surrounding fat. Such glandular enlargement must be sought for up to the bifurcation of the common iliac artery and along the promontory of the sacrum. During this procedure there is sometimes considerable oozing from the rich venous plexuses in the pelvic cellular tissues, but this can always be controlled by pressure with gauze or sponges. The ureter corresponding to the affected side of the bladder is now located and dissected out down to its entrance into this viscus, and the pelvic space is carefully lined with iodoform gauze so as to prevent its infection during subsequent manipulations. The bladder is opened in healthy tissues to one side of or above the tumor, and the surface of the neoplasm at once cauterized with the actual cautery or pure carbolic acid. I deem it the better plan to remove the neoplasm after the bladder has been opened, working from the interior outward, rather than to excise the tumor mass from without inward, for with the limits of the neoplasm directly visible it is possible to make a wider resection into healthy tissue. If the neoplasm is found to involve the lower end of the ureter, this is divided

in healthy tissue and the proximal end temporarily closed with a seraphin to prevent leakage of urine over the field of operation. The stump of the ureter is then reimplanted into the *vertex* of the bladder.

This reimplantation into the vertex, as against reimplantation into the base of the bladder at the site previously occupied by the neoplasm, is important for the following reasons: In the first place, if the ureter is implanted into the bladder at the site from whence the neoplasm has been removed, it will be very difficult to effect an impervious junction, and furthermore, inasmuch as at this site there is likely to be some marginal necrosis, the liability of ascending infection from such necrosis along the ureter to the kidney is very much increased. The defect in the bladder caused by the removal of the neoplasm is now closed with two layers of sutures, one a catgut Connell suture passing through all the walls of the viscus, and the other an external mattress suture of fine silk going through only the muscular coats. I have found it sufficient to drain the bladder through the urethra, but if deemed necessary a suprapubic opening for drainage may be established. It is very essential to provide liberal gauze drainage of the cellular tissues in the pelvis, always, however, taking the precaution to place a strip of rubber tissue between the suture line in the bladder and the gauze. The bladder drainage is removed after six days and the patient is permitted to pass his urine spontaneously. Frequent washings of the bladder at this time will relieve the cystitis resulting from the operative manipulations.

Thus far the writer has had occasion to practice this operation four times. In two of the cases the growth in the bladder was secondary to extensive uterine carcinomata, one of the patients being a young woman with extensive vaginal, uterine and broad ligament carcinoma, in whom radical operation was undertaken only because of the extreme youth of the patient and at the earnest solicitation of her friends and relatives. In one of these patients there was a recurrence of the malady in the pelvis a year and a half after operation, and in

the other evidences of returning carcinoma appeared after six months. Neither case was a favorable one for radical cure. As regards the bladder complication, although one-third of this organ had been removed and the ureter reimplanted into the bladder, the patient was able to hold the urine almost as well as in her normal state.

In a third patient the bladder cancer appeared to be favorable for operation. There was noted in the prostate before operation a nodule about the size of a small hazelnut which was not, however, thought to be malignant. The neoplasm in the bladder about the size of a silver half dollar and of a squamous-celled type, together with the terminal half inch of the left ureter was removed, according to the method described above, and the ureter was reimplanted into the vertex of the bladder. An uninterrupted convalescence took place. The wounds were completely closed at the end of four weeks, the patient had perfectly normal bladder function, and remained well for fourteen months after the operation. He then showed evidences of prostatic enlargement, and on examination it was found that the previously described nodule in the organ had increased very considerably in size and was hard and fixed. The removal of this nodule was deemed inadvisable and the patient succumbed to a prostatic cancer somewhat more than a year later, a little over two years after the operation. In this case the bladder tumor was probably secondary to the prostate cancer, and the prostate should have been removed together with the bladder tumor.

The fourth patient was a favorable one for radical operation. He had a tumor about the size of a silver half dollar occupying the right side of the bladder and the right ureteral orifice, was in good physical condition, and about 58 years of age. The lymphatic glands and bladder tumor were removed in the usual manner, but I deviated from my usual practice of reimplanting the ureter into the vertex of the bladder and followed the suggestion made by a colleague of making the ureteral implantation into the base of the bladder at the site occupied by the neoplasm. All went well until the sixth

day, when there were evidences of septic infection, a pneumonia developed at the base of the lung, and the patient succumbed three days later. At the autopsy it was found that there had been a leakage of a few drops of urine at the site of the ureteral junction and that there had been an ascending infection of the pelvis of the right kidney, which contained a few drops of pus. Whether this last mentioned condition or the pneumonia was the cause of death it is, of course, difficult to say, but the fallacy of reimplanting the ureter into the base of the bladder was well demonstrated, and in subsequent cases I should certainly not select this site for reimplantation. Unfortunately the writer was not aware that Albarran and Rafin have had the same experience with reimplantation of the ureter at the base of the bladder. They likewise have come to the conclusion that in partial cystectomy involving the ureteral orifice it is far more advisable to reimplant the ureter into the vertex than into the base of the bladder.

Simple removal of a cancerous tumor from the bladder, either by the curette or knife or actual cautery through a suprapubic opening without partial or complete cystectomy, has not been considered in this paper amongst the radical operations for this disease, although there are cases in the literature of a permanent cure having been accomplished in this way. Such instances are very rare and a lasting cure by an operation of this kind is possible only when the tumor is a pedunculated one and its base not infiltrated with malignant disease.

## DISTURBANCES DUE TO DISEASE OF THE VERUMONTANUM AND ITS TREATMENT WITH THE POSTERIOR URETHROSCOPE.\*

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OF NEW YORK.

WORK upon the posterior urethra through the urethroscope during the past eight or nine years has convinced me that it is a valuable aid and a distinct advance in the treatment of trouble in that portion of the genito-urinary tract, and that many obscure symptoms may be found to be due to disease or to some pathological condition of the verumontanum, or of the urethral floor in its immediate vicinity.

The most common cause of trouble in this part is, of course, chronic gonorrhœa, though I have had a large number of non-venereal cases in which trouble with the verumontanum seemed to be the disturbing element. The association, further, in many of these cases of an oxaluria has made me believe that this might be a factor in the pathogenesis of both these classes of cases. At the same time, while in some cases of oxaluria attention to the digestive tract has been sufficient to clear up the symptoms, in others the symptoms have persisted until the posterior urethra has been treated through the urethroscope. The following case seems to me to be typical of this condition.

B. D., 19 years old, consulted me as recently as March 14, 1908. For three years he has been troubled by persistent and frequent nocturnal emissions, constipated habit, facial acne, clammy hands. Has been obliged to give up studies which he was pursuing at night, while working during the day, so that he feels he can make no advance, unless his condition can be relieved.

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\* Read before the American Association of Genito-Urinary Surgeons, May 1, 1908.

During this time has been almost constantly seeking relief of one physician after another. During the week preceding his coming to consult me, had had emissions every night. The urine was loaded with oxalate of lime crystals. Never had venereal disease. There was a slight mucoid discharge which can be squeezed out of the urethra; contains bacteria, but no gonococci. The prostate and vesicles reveal nothing to the examining finger. Examination of the posterior urethra showed the entire verumontanum to be much swollen, very hyperæmic, bleeding very easily on touch with the cotton swab, and also on relief of pressure as the mucous membrane comes up into the window of the instrument during its gradual withdrawal. The entire floor of this portion of the canal was freely swabbed with a 10 per cent. solution of silver nitrate, or what is practically the same thing, argentamine in full strength. Attention was also paid to the digestion with a view to eliminating the oxaluria. The patient received five such applications at weekly intervals. At the last examination on April 11th the verumontanum was perfectly normal as seen through the urethroscope, it was not hyperæmic, it did not bleed. The oxalate of lime crystals were not found after the first examination and during these four weeks he had had but one nocturnal emission.

I do not mean to say that this case is by any means cured, but a healthier condition of the posterior urethra, especially the verumontanum, has been brought about more quickly than by any means with which I am acquainted, and it so clearly illustrates one phase of this condition, that of the simplest, that I cite it here.

In my experience this has generally been the condition of the verumontanum which has been found in these non-venereal cases:—a swelling and a hyperæmia of the entire verumontanum and a marked tendency to bleed easily.

In the cases which have been dependent upon a chronic gonorrhœa there has been a great variety in the urethroscopic picture as well as in the symptoms. In many of the cases in addition to the hyperæmia and swelling which is almost always present with the tendency to bleed on slight touch, there is a real hypertrophy as if due to a round-cell infiltration, and there is irregularity in the shape of the verumontanum and

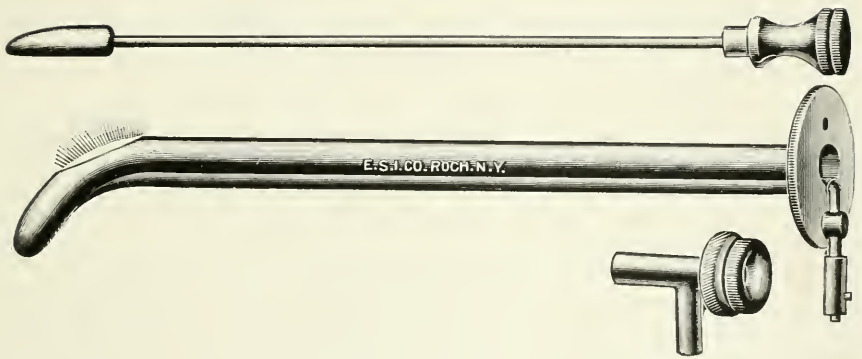
variations in the appearance of the surface of the mucous membrane, in some cases dull and dry and deeply reddened, or the surface is granulating, or there is a small granulation patch here, and there a small area looking like a bit of raw beef, and the general surface very irregular. There may be small excrescences looking like polypi springing from the surface of the verumontanum, there may be a small granulation tumor, a granuloma. This latter condition I have met with in two cases, and I can recall but two cases in which I have met with polypi.

The symptoms vary; there may be a simple mucoid or mucopurulent drop in the morning, or this condition may be constant without other symptoms. The urethra, on the other hand, may be perfectly dry. There may be a neurasthenic condition of any varying degree, and it may in some cases be accompanied by frequent nocturnal emissions and even diurnal. The seminal secretion may be blood-stained. There is in some cases—and this, I think, I have found in the majority of the cases—premature ejaculation or there may be complete impotence. Some of the cases complain of pain; this may vary from a slight feeling of discomfort along the urethral canal, or a tickling or a burning sensation, to a sharp lancinating pain. This pain or discomfort may, in some cases, be referred to the navicular fossa, or to the perineum, or to the deep urethra in front of the rectum, or over the pubes, sometimes over the sacrum. It may not be of great severity. In some cases there may be pain in the deep urethra, as if a foreign body were present. These pains are generally independent of the act of urination, or the pain may come only at the end of urination. Neuralgia of the testicle or in the sciatic region I have met with.

I have not attempted to give a complete account of all the symptoms which seem to be due to disease of the verumontanum, but only the most prominent and characteristic. I have presented this paper with a view to exhibiting to this society my instrument, already no doubt well known to you, to give

the reasons why I believe it to be the most practical working instrument to-day for dealing with the posterior urethra, finding, the more I have worked with it, the more satisfactory it has become. It was after considerable experience with the straight tube in the posterior urethra with the cold lamp, that I felt that a curved tube would prove more comfortable to insert, and it was in November, 1900, that I first ordered an instrument so constructed. The first sent me had the light in the beak, as in the *aëro-cystoscope*; I then saw that the light must be in front of the window for proper illumination, as the floor of the urethra filled the window and the mucous membrane was illuminated by transillumination. In January, 1901, I obtained the first practical instrument, the beak was left hollow, however, and my experience with one case, which is related below, led me to have this remedied. The first method to remedy this, was to fill the beak with cement, which was not satisfactory; afterwards it was filled with metal, as in the present instrument (Fig. 1). Three sizes were made: 24, 26 and 28 F., but of late years I find I use the size 24 almost to the exclusion of all others. An objection made to the instrument has been that one could not see lesions on the roof of the posterior canal. In working with the straight tube, I never saw any lesions in the roof. Most of the lesions are about the verumontanum. I have also come to prefer an instrument in which the Koch auxiliary chamber keeps the lamp out of the way, when treating the mucous membrane. I have had instruments made, in which the lamp was in the tube itself, for use either with the Chetwood lamp or the Otis light, but the Chetwood lamp interfered with swabbing, and the Otis light in my hands does not give as good illumination, nor is it so convenient in treating cases. In one instrument there was an attachment with window, so that air dilatation could be used in the posterior urethra, but I have not found that the surface is any better illuminated; lesions cannot be treated without removing the apparatus; and then, too, any moisture in the canal is blown through the chamber carrying the light, which interferes with

FIG 1.



Posterior urethroscope.



vision and might be productive of danger to the eye of the operator. Though this could be obviated, I have not attempted to do so.

In inserting the instrument, the patient lies on the table, hips slightly raised, the lamp is tested before being placed in the instrument, then the cord is detached. While inserting it I stand on the patient's right and insert the instrument as in passing a sound. When the beak reaches the cut-off, I change the instrument from the right to the left hand, pressing down above the pubes with the right hand, while with the left I gently push the instrument into the deep urethra until it has reached the point I wish, which should be so that the very posterior tip of the verumontanum with the portion of urethra posterior to it will come into the window. The cord is then attached, the broad shield is grasped between the finger and thumb of the right hand and held perfectly still, the wrist and palm of the hand resting on the symphysis, and then I gently withdraw the obturator. If the instrument has not been inserted far enough,—I can tell this by the appearance,—I often push the instrument deeper while looking through it at the window, without reinserting the obturator. If the instrument has passed too deep, and there is urine in the bladder, it will come into the tube. If there are only one or two drops, it can be removed with the cotton swab; if more comes, I withdraw the instrument and reinsert it.

Almost the only treatment which I have applied to the posterior urethra has been a 10 per cent. solution of silver nitrate or argentamine in full strength. In the March number of the *Zeitschrift f. Urologie*, 1908, p. 219, I have noted that Wossidlo, of Berlin, in an article on this subject, has used 20 per cent. silver nitrate and in some severe cases has used the electrocautery, applying it directly to the diseased portion. In this article Wossidlo presents an instrument very similar to mine, but the lamp is in the same chamber, and for that reason I do not think it as practical; furthermore, the manner of inserting the light renders the calibre through which the applications are made, smaller than the calibre of the tube. I

should think, however, that for granuloma or polypi the electrocautery would prove an excellent aid.

The manipulations, of course, are done under aseptic precautions. There is no after-pain in making application with this strong solution of silver nitrate and, as a rule, no discomfort except for the burning sensation at the next two or three times of urination, even though the cotton swab is soaked with the solution and freely applied, whereas I think, all will acknowledge the extreme discomfort of silver nitrate in much weaker solution, when applied through the instillator, an instrument I but very seldom use now. Furthermore, the latter is applied in the dark and does not reach the whole of the portion intended. Then, too, I have treated and cured many cases with the urethroscope that had had the instillation method applied for months by other operators.

I never use the urethroscope while gonococci can be demonstrated to exist, and seldom use it for treatment until all other pathological conditions, as trouble in the anterior urethra or prostatitis and seminal vesiculitis, have been removed so far as possible. These lesions are always treated until they seem incapable of further improvement; then, if the case seems to need it, I employ the urethroscope. I have sometimes had cases in which the gonococcus for a long time could not be demonstrated; one case I remember, in which marriage had been sanctioned by two competent men, in which after one or two or more applications through the urethroscope, a urethral discharge started up containing gonococci, and that, too, without further exposure to infection. When this has happened, and it has happened often enough for me to be on the lookout for it, I refrain from further use of the urethroscope until the trouble subsides. I have noted in some cases, having as a symptom frequent nocturnal emissions with an accompanying vesiculitis and prostatitis, that, while at first massage and treatment directed to these parts helped that symptom, it would return again, even while the treatment was carried on. In my experience these cases need treatment with the urethroscope.

The treatment is carried on by making the application once a week only—seldom have I ever made the intervals shorter, though in a few cases I have made them at intervals of five days. The average number of treatments has varied from three to twelve, sometimes more, but in such cases the intervals have been lengthened to once in two weeks and even longer as the condition has improved.

The following cases present interesting points:

CASE I.—H. B., 26 years old, was treated for an acute gonorrhœa in the spring of 1899,—it was his second attack. His first attack had occurred six years before and he had always after that suffered from its results. The present attack followed the only exposure since the first attack. Following his first attack he had had a double epididymitis, which occurred nine months after its beginning. After that he had had an internal urethrotomy performed, after this he suffered a good deal from neuralgia of frequent recurrence in the left testicle, had been treated for prostatitis and seminal vesiculitis by massage, without benefit to the condition of neuralgia. When he came to me, he had had these attacks of neuralgia for four years. He presented a mild degree of neurasthenia, and strongly objected to any urethral instrumentation, as he had had so much of it without benefit and had suffered much pain in consequence. Nevertheless, after his gonorrhœa had subsided, I persuaded him to consent to a urethroscopic examination of the posterior urethra. The verumontanum was much enlarged and the anterior half presented a granulating patch which I swabbed freely with a 10 per cent. solution of silver nitrate, and thereafter made five or six similar applications a week apart. He never had a return of the neuralgia after the first application, and at the last application the urethra presented a normal aspect.

The difficulties met with in this case especially brought me to consider the instrument which I had made.

CASE II.—A. M., 29 years old, came to the dispensary in the latter part of 1900, having a chronic gonorrhœa. Had recently come out of the hospital, where he had been laid up with double epididymitis. He had lost flesh and strength, his urine was very cloudy, his prostate was very much enlarged and he was still under treatment for his epididymitis. He suffered from consider-

able pain in the deep part of the canal, and in January, 1901, I examined him with the posterior urethroscope, he being one of the first cases on which I had used it. The passage of the instrument caused much pain, on withdrawal of the obturator the verumontanum came into the window. It was much hypertrophied, the surface was granulating, and in its middle portion appeared a small tumor like a granuloma. The surface was thoroughly swabbed, but on withdrawing the instrument, the tumor was found to have been curetted off and was in the beak of the instrument. It was followed by only a slight amount of bleeding, and several applications were made after this, and the patient was greatly improved and disappeared. Subsequently, five years later, he presented himself at my office, having an oxaluria, and, in conjunction with treatment for that condition, I had occasion to treat the posterior urethra for a congested condition making about four or five applications. Outside of this condition the canal was normal, and it was interesting to see it so many years after a considerable pathological condition had existed.

It was the accident occurring in this case which fortunately was a beneficent one, which led me to have the beak of the instrument filled to prevent a similar subsequent occurrence.

In many of these cases which I have thus treated, I have had occasion to re-examine the urethra after a longer or shorter interval following a course of treatment, and have been struck by the normal appearance of the verumontanum.

When I began urethroscopy of the posterior urethra, I feared the possibility of one accident, hemorrhage into the bladder from a profuse bleeding from this surface, but as time went by and no such accident occurred in any of the very great number which I have treated—I have the records of over a hundred cases during that time in my office practice and certainly many more in my dispensary work—I began to think this danger a slight one. Nevertheless, it did occur in the practice of one of my assistants last year. One Sunday morning, about eight o'clock, he telephoned me he was sending up a patient he wished me to see. The man came to my office suffering extreme pain. He had a constant tenesmus, made constant efforts at urination, and only a few drops of blood

passed. The distended bladder could be felt above the symphysis, a hard mass the size of a cricket ball; pressure over this tumor increased the pain immensely. Before sending him into a hospital, I thought I would see what could be done to relieve him. I passed a silk-woven catheter into the bladder, drawing off only a little blood, and then washed out the bladder as gently as possible with a warm solution of alphozone (quite hot), following this with a weak solution of peroxide, and then finished with a weak solution of adrenalin. Although the bleeding was not entirely stopped, he was much more comfortable, after I had succeeded in removing all the clots and while doing this elicited his history. For some time previous he had had massage of his prostate and then was subjected to a course of treatment with the urethroscope, having been treated with it about seven times in all, the last one being on the previous afternoon, when he was told that there was no more need of treatment. No bleeding had followed this last treatment, and at ten o'clock that evening he had passed a perfectly clear urine; but at one o'clock in the morning, while at work (he was a baker), he had occasion to urinate, when he was much frightened to find he was passing what appeared to be pure blood. This was quickly followed by the sensation of a full bladder and constant efforts to urinate with the passing of blood, until he was sent to me that morning.

I gave him urotropin and sent him home to bed, and visited him that evening; he had, during the day, passed rather frequently blood-tinged urine, but no blood or clots; he was very sore. The urine continued blood-tinged for forty-eight hours, then passed away. Two weeks later I made a cystoscopic examination of the bladder and found it normal.

## FIBRINOUS CALCULI IN THE KIDNEY.

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IN considering urinary calculi, we are accustomed to think of the difference in consistence between the hard uric acid and oxalate of lime calculi, and the softer stones composed of the alkaline phosphates; the former so hard as to offer great resistance to the lithotrite, the latter crumbling easily.

But we are apt to forget that there are other bodies even softer, whose definite form and infiltration with crystalline deposits, bring them within the general classification of urinary calculi. They are sometimes spoken of as "blood calculi," "fibrinous concretions" or "colloid stones,"—are not very common, and the number of reported cases is very small. Their variety, and their bearing upon the theories in regard to the formation of urinary calculi, would seem to make them of enough interest and importance to warrant a brief description of such a case which came under our observation in 1906.

Miss A. C., 56 years old, was referred to the Memorial Hospital May 20, 1906, by Dr. P. T. O'Brien, of Clinton, Mass. Her father died of typhoid fever, her mother of "heart disease"—there is a history of tuberculosis on the father's side, but none in the immediate family; five sisters and one brother are dead; one after a long illness, at 24 years, nature not known,—the others, all from acute infectious diseases. The sister who is living, has been "troubled with gravel and has passed hard stones," but is now in excellent health, 60 years old.

She had pneumonia at seven, was sick two or three months, and has ever since been subject to coughs; has occasionally had a bloody expectoration. Had typhoid at 17, and jaundice at 19.

For several years was troubled with indigestion, pain in epigastrium and nausea, and in 1902, was jaundiced again. On September 6, 1902, at Memorial Hospital, she was found to have

an enlarged gall-bladder easily seen and felt, with the liver extending three inches below the level of the ribs; a gall-stone was found obstructing the cystic duct, and was successfully removed. Menstruation had ceased when she was 50 years old.

From the time she was 15 years old, until she was 30, she passed gravel in the urine—a gray-colored sand, that settled in bottom of chamber, would not wash out, and often had to be scraped out; none of this between 30 and 35, but in February, 1885, while dressing, was taken with severe pain in right side of back, with urgent desire to urinate. The urine was dark blood color, with small clots. During the morning, urinated every 15 to 30 minutes and the dark color of the first urine gradually changed to a bright blood color. Three days later the blood and increased frequency had disappeared, and the urine had become normal.

Two months later, after walking up a hill, had a second attack of pain, similar in character, but much less severe than the first, lasting but a few days; blood showed in urine twice on first day of attack. The next winter, 1885-1886, for two or three months, had several attacks of pain along line of right ureter; these occurred in day or night, often with several weeks between, lasting several hours, and disappearing gradually.

These attacks were always accompanied by smoke-colored urine, in which was a sediment of "a black, smoky dust." During the period in which these attacks occurred, she was unable to start quickly, reach far above her head, or go up a hill without inducing pain in her right side. Once in reaching for a picture, hanging on the wall, she was taken immediately with a pain which began one of these attacks.

From that time until 1904, she felt pretty well, did considerable work about the house, and had little or no trouble with her side. In 1902, at the time of her cholecystotomy, examination of the urine showed that it had a specific gravity of 1017, was acid, contained a very faint trace of albumin, no sugar, and in the sediment a few leucocytes and a few red blood corpuscles. On the day following the operation, there were also numerous epithelial and granular casts.

*Present Illness.*—Two years ago, while riding in an electric car, felt annoying pain in right back, extending down right side toward bladder. Urinated once an hour, urine contained no

blood, but was thick and ropy. Similar attacks, beginning with severe, sudden pain, and lasting five or six days, recurred at irregular intervals, until present.

These attacks confined her to bed, and were accompanied by chills, fever and vomiting. For several months the attacks were infrequent, but toward spring increased in frequency, lasted longer, and were more severe. In August, 1905, she passed four small stones and from then until the time of the operation, thinks she passed between 30 and 40; some as large as a good-sized bean.

Miss C. was very thin, skin had a yellowish color, tongue was coated, breath sounds were harsh on the left side anteriorly, heart was normal. There was marked tenderness on the right side of the abdomen, but the right kidney was but indistinctly felt, tender, but not enlarged. Pulse, 68, temperature, 98.5°; respiration, 20.

The urine, on entrance, had a specific gravity of 1020, was alkaline, had a faint trace of albumin, no sugar. In the sediment were no casts, and no blood, many bacteria, mucus, few leucocytes, epithelial cells, amorphous phosphates and dicalcic phosphatic cystals.

A cystoscopic examination of the bladder was made on the 26th of May, by Dr. H. W. Beal, with the following results:

Nothing abnormal noted in appearance of bladder. Twenty-seven c.c. of urine were withdrawn by catheterization of the ureters from each kidney; that withdrawn from the right kidney was yellow, alkaline, sp. gr. 1010; it contained a distinct trace of albumin, no casts, numerous amorphous urates, no tubercle bacilli, but many uric acid crystals, epithelial cells, bacteria and pus-cells, with a few red blood corpuscles. From the left kidney, amber, acid, sp. gr. 1026, with marked trace of albumin, uric acid crystals, epithelial cells, and red blood corpuscles.

In spite of the presence of red blood corpuscles and epithelial cells in the urine of the left kidney, inasmuch as the amount of urine and its specific gravity were satisfactory, it was determined to cut down upon the right kidney, which had been the constant seat of the pain, and from the presence of the pus-cells and bacteria, was evidently the seat of a marked pyelitis.

Accordingly, on June 1, 1906 the kidney was exposed through a six inch lumbar incision; its external appearance was normal but the pelvis and upper end of ureter were markedly

dilated; a small incision revealed the presence of numerous calculi in pelvis of kidney, extending well down into the ureter. The kidney was removed entire, and the end of the ureter was sutured to the skin.

The operation was done under gas-ether, and occupied 35 minutes; her convalescence was delayed by a severe bronchitis, and some superficial suppuration, so that she did not leave the hospital until July 3, 1906, five weeks after the operation.

Examination of the urine, made after the operation, showed always a distinct trace of albumin, a specific gravity ranging from 1010 to 1024 a few hyaline casts on the second day, none afterwards, and always many leucocytes. Four weeks after the operation, she was passing 13.68 Gm. of urea in 24 hours.

She was re-admitted to the hospital August 27, 1906, with a sinus six inches deep in the line of incision; this sinus was enlarged, curetted and packed with iodoform gauze; it was entirely healed, and she returned home on September 17th. At this time, her urine still contained a large trace of albumin, and many leucocytes. A catheterized specimen was not obtained.

*Subsequent History.*—At the present time, Miss C. reports that her general health has been very much better since the operation; that she has weighed more than for five or six years past, and that she has been able to work. She looks well, and physical examination reveals nothing abnormal. She passes about 24 oz. of urine in the 24 hours, and has no increased frequency, and no pain.

Examination of urine, obtained per catheter, showed normal color, acid reaction—specific gravity, 1014. Albumin, by nitric acid absent; by heat test, a slight trace. Sediment, obtained by centrifuge, showed an occasional leucocyte, and very few bacteria—amount of urea was 1 per cent.

We think it may be safely inferred, that the remaining kidney presents none of the pathological conditions which characterized the one which was removed. Examination of the kidney after its removal showed that the capsule was not adherent and the renal substance was but little thickened; the pelvis of the kidney was tensely distended and completely filled with clay-colored bodies which turned brown after exposure to the air, were of the consistency of moderately hard putty, and varied in size from a large bean to the head of a pin.

There were 10 or 12 large ones, and a great many smaller ones, more than 100 in all; all, even the smallest, presented smooth, faceted surfaces, like those of gall-stones. Their general appearance, as they lay in the pelvis, and extended down into the ureter, is admirably shown in the accompanying drawing.

The specimen was subsequently sent to Dr. F. B. Mallory, whose report is as follows:

"Specimen consists of kidney, incised through the hilus, and preserved in alcohol. The kidney is a little enlarged, and the pelvis and beginning of the ureter are considerably distended. The latter contained in the fresh state many soft, more or less rounded, reddish-gray masses, some of which are still attached to the calices of the kidney; the others are free in the alcohol. (Figs. 1 and 2.)

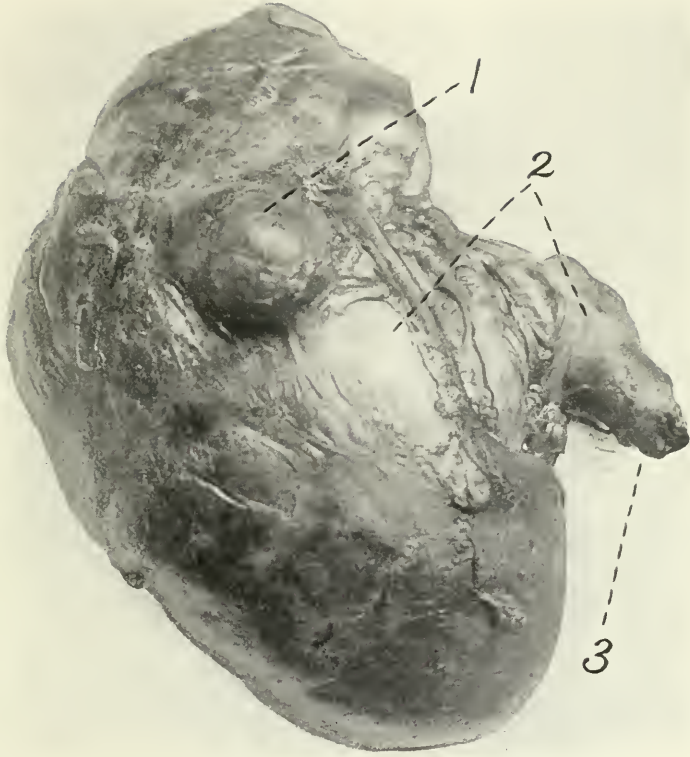
"They vary very much in size; the largest received measures  $1.8 \times 1.3 \times 0.9$  cm. They are irregular in shape from pressure against each other, are easily broken up, and seem to be composed of thin layers. Microscopically, after decalcification the material seems fairly homogeneous; but it shows a concentrically laminated arrangement, and in places there is a meshwork, evidently composed of fibrin threads, out of which each calculus is probably formed."

Some of the calculi were sent to Dr. R. L. Emerson, to determine the nature of the infiltrating salts, who reports: "The renal calculi which I received from you July 16th, are composed chiefly of calcium phosphate. There was mixed with the calcium phosphate, more or less altered blood which tended to cover the stones at various times during their formation and accounts for their more or less concentric appearance. I could get no test for uric acid, triple phosphate, or calcium oxalate."

These calculi consist, therefore, of alternating layers, concentrically arranged, of calcium phosphate and fibrin, and may be properly classified as fibrinous calculi.

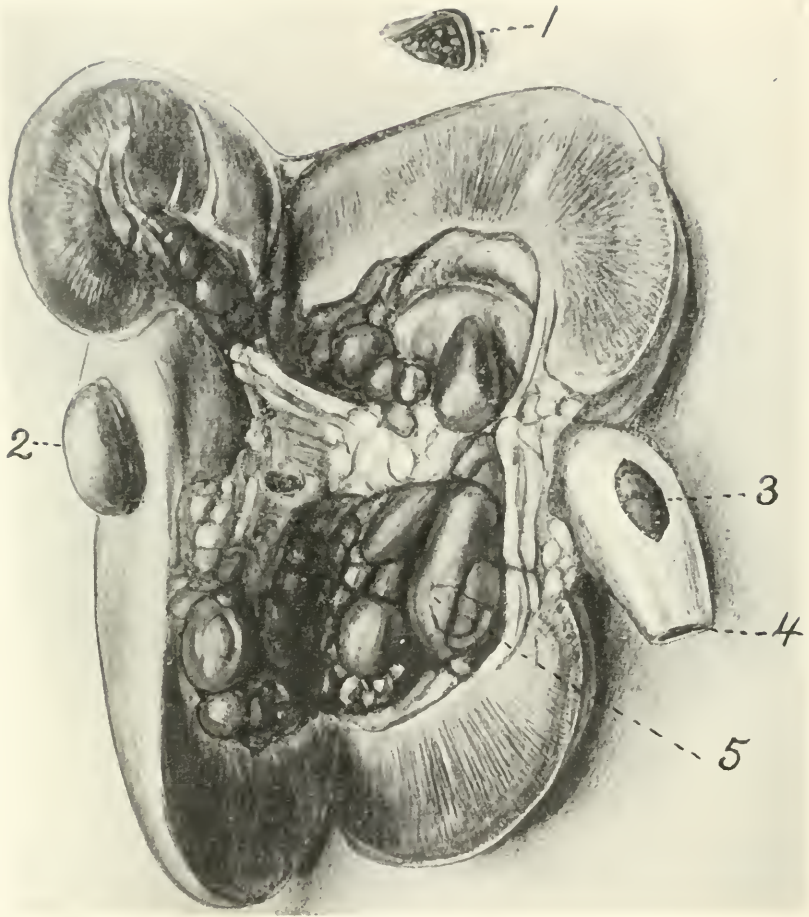
The first mention that we have been able to find of fibrinous calculi, occurs in Marcet's "Calculous Disorders" (1817), in which he says of a calculus sent to him by Sir Astley Cooper, that "It was neither cystic nor uric, but that it appeared to consist of hardened animal matter, probably of the albuminous kind; that upon closer examination its properties correspond exactly to those of fibrin, and therefore if the occurrence of similar concretions should render it necessary to give them a name, they might, I think, without impropriety, be called fibrinous concretions." The patient from whom this

FIG. 1.



1. Surface cyst. 2. Pelvis and upper end of ureter distended with calculi. 3. Cut ureter.

FIG. 2.



1. Section of calculus. 2. Surface cyst. 3. Window showing pelvic portion of ureter crowded with calculi. 4. Cut ureter. 5. Pelvis of kidney, dilated and crowded with calculi.

specimen was obtained, had already passed three calculi of similar character, and all nearly the same size, viz., "Size of a pea."

In 1837, Dr. Hodgkin described two calculi taken from the bladder of a boy, aged two years; and the description is so like the calculi found in our case, that it seems worth repeating.

"Instead of presenting the hardness and resistance of solid bodies composed of earthy matter, they possess, on the surface at least, a degree of softness and elasticity, as if covered with a fleshy layer. The material of which the surface was composed, exhibited a slight degree of translucence, not unlike that of some blighted acephalocyst membranes. These unusual characters induced at first some doubt respecting the nature of these bodies.

"Section made through one of them, showed that they in part consisted of an opaque white substance, having an earthy texture arranged in concentric but fragile layers. Two or three thin layers, consisting of a material precisely similar to that of which the external coating of the calculi was composed, were situated between the layers possessing the earthy character.

"Although the earthy layers were so brittle as to be crushed by the act of making the section, the fragments were so completely retained in their relative situations by the tenacity of the membranous layers, that the two portions into which the calculus was divided, were able to retain their form and cohesion."

Dr. Hodgkin believed that, "A nucleus existing in the bladder at the time became invested with coagulated fibrin, as a stick does when agitated in recently drawn blood; that when the character of the urine again changed the deposition of phosphates took place and inclosed the fibrinous layer."

The repetition of these occurrences appears sufficiently to account for the production of these calculi, and to be strictly analagous to the process by which other alternating calculi are formed.

Civiale refers to bladder masses which have to be exposed before they can be recognized as true semifluid calculi, in which the animal matter greatly exceeds the mineral matter; and further, of small gravel stones of soft consistency, combined with a large quantity of semiliquid substance.

His references are plainly to the thick mucus, which he says often dries outside the bladder in dirty gray scales, and can collect on the surface of a vesical calculus and there pro-

duce a real horny layer. He also mentions a fibrinous calculus, the size of a bean, yellow, and half transparent, which was extracted from the bladder of a cadaver by Sir Benjamin Brodie. It had the appearance of amber, lost much of its volume in drying, and its presence had not been suspected during life.

In 1857, J. Scott Alison, in examining the body of a man who had died of consumption, found "the left kidney to be greatly atrophied, changed in structure, and to have the infundibula and pelvis stuffed with hard bodies, most of which are of a coal black color. The largest of these is the size of a horse bean, looks somewhat worn and disintegrated, and at one point resembles a piece of decayed wood. At one side it is black from the pressure of altered blood. It is very light in weight, and is composed of blood and phosphate of lime."

To these he gave the name of blood calculi, and explained their formation by the presence of an "inflammatory action, set up perhaps by the pressure of small calculi of phosphate of lime. Blood was probably effused in consequence, and from suppression of urine, remained in the infundibula and pelvis, and failed to be washed down the ureter. This blood hardening, would form the calculi which were discovered."

Roberts, in his "Treatise on Urinary and Renal Disease," refers also to calculi of inspissated blood, and refers to a case in which several such concretions were found loose in the infundibula and pelvis of a kidney which had been ruptured by external violence. These seem to have contained little or no earthy matter, but he says, "Such concretions sometimes serve as nuclei for uric acid or oxalate of lime calculi."

Generisch, in 1903, showed "a colloid stone from the renal pelvis, found in a 39-year-old porter; granular contracted kidneys, and cardiac hypertrophy were present."

"The calculus is the size and shape of a castanea nut, tapering at one end, measuring 32 x 29 x 24 mm., weighing 13.9 Gm. The surface is smooth, with the exception of protuberances the size of a bean in two places. The color is grayish-brown, somewhat translucent. A needle can be inserted 4 mm. deep into the calculus, when it strikes a hard nucleus.

"On section, the calculus shows a hard nucleus, the size of a hemp-seed, formed of black calcium oxalate, surrounded by a softer light red layer of uric acid. The latter was followed by a firm layer of calcium oxalate, which in turn was surrounded by a yellowish mantle of urates."

The tetrahedral nucleus described above, "was covered with a colloid layer, in the form of scales and lamellæ, which could be scraped off with the finger-nail or cut with a knife." He goes on to say, "that the colloid covering of the calculus seems to give a hint as to the growth of calculi in general."

"The scales and lamellæ point to the conclusion that the organic formed substance of the calculus is deposited first, and the inorganic substance added later. On the other hand it is not impossible that a colloid layer might have been deposited in the renal pelvis, secondarily and independently of the calculus formation; as we are dealing with a case of contracted kidneys in which there is abundant formation of colloid substance."

In 1904, Dr. Elliott, of Boston, published an account of two fibrinous concretions successfully removed from the bladder of a man 54 years of age. "They were of a lightish-yellow color, with smooth surfaces, slightly wrinkled, and of the consistency of firm putty. The structure was homogeneous, slightly gritty, giving the impression of coagulated material, fibrin and mucus mixed with particles of urinary salts, in the centre of which was a small nucleus, composed chiefly of calcic phosphate."

In 1906, appeared an article by Dr. Piolet, on "Calculus Pyonephrosis with Abnormal Organic Concretions—Lumbar Nephrostomy—Recovery." The essential features of this most interesting case were the removal, by incision of the kidney, of half a litre of thick, yellow, fetid pus, about 50 dark soft concretions, and two round hard calculi.

These soft concretions varied in size from that of a grain of wheat to that of a large nut. They were elastic, like rubber; in shape, generally round, with facets flattened by reciprocal pressure. They proved to be almost entirely composed of organic matter in concentric layers, albuminoids and fibrin. The ashes were composed of phosphates, in very small quantities.

The similarity between the calculi described in these re-

ports, and those found in our own case, will be readily observed. In none were so many found, however, as in our patient; and in but one, was the smooth, faceted appearance noted, such as is commonly found in gall-stones. Most of them present a framework of fibrin, in which have been deposited crystals of phosphate of lime.

If we accept Rainey's theory of the formation of urinary calculi by molecular coalescence, a theory which has been further elaborated by the observations and experiments of Ord and Ebstein,—these differ from the more common calculi simply in having a large excess of the colloid or cement in which the inorganic salts of the urine are deposited,—from the great predominance of this cement, we are able easily to demonstrate that it is made up of fibrin, and not of mucus, pus, or other albuminoids.

The origin of this fibrin in our own case, as is believed usually to be true of fibrinous calculi, lies in a previous hæmaturia, which from the patient's history, occurred at several different times, and quite profusely a few years before she came under our observation.

The cause of the hæmaturia is not clearly established by the examination of the kidney, and we have no means of knowing whether the bacterial invasion of the renal pelvis preceded or followed the hemorrhage.

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## HÆMATURIA AS A COMPLICATING FACTOR IN APPENDICITIS.

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THE following three cases illustrate the practical difficulties encountered as a result of the development of hæmaturia due to appendicitis.

CASE I.—P. F., 28 years old, a native of Russia, gave a negative family and past history. Present history dates back three months, during the course of which time he had two acute attacks of abdominal pain. These attacks had been diagnosed as appendicitis by a New York surgeon who had also advised operation. A week before admission to the Jewish Hospital of St. Louis he had a similar typical attack of acute appendicitis. When the patient entered the hospital all acute symptoms had subsided, and the physical examination was negative except for a slight residual tenderness over McBurney's point. The urine at this time was free from all pathological elements. Preparation for appendicectomy was ordered, but about eighteen hours before the time set for operation the patient suffered excruciating pain in the right lumbar region. His temperature rose a degree and a half, but his pulse-rate remained normal. There was only minimal pain over the appendix, but slight pressure in the lumbar region caused great pain. This lumbar pain remained localized, and did not radiate along the right ureter. An examination of the urine, made at this time, gave the following findings: sp. gr. 1015, color, dark brown, turbid; reaction, acid; albumen, trace; sugar, none; casts, none; blood, abundant (20 to 100 red cells to a field). On the basis that the attack might be due to renal colic rather than to appendicitis, we deferred operation. An X-ray picture was taken but it did not show the presence of a stone. A cystoscopic examination was negative. No tubercle bacilli were

found in the urine. This attack lasted two days, and after its subsidence the patient was observed for three weeks. During this period there were two attacks exactly similar to the first one. Exploratory laparotomy was now decided upon, with the idea of examining the appendix first, and if that organ were found to be normal to expose the right kidney. The operation disclosed a very acutely inflamed appendix. The patient was traced for six months after the appendicectomy, and during this time he was hard at work, manifesting no evidence of renal or intraperitoneal disease.

CASE II.—A. S., 28 years old, Russian, peddler, family and past history negative. Three days before admission to the hospital he had an acute attack of pain limited to the right iliac fossa and right loin, accompanied by fever ( $101^{\circ}$ ) and tenderness over the whole right side of the abdomen. There had been no chill, no vomiting, and no other symptoms referable to the gastro-intestinal tract. The disease had been diagnosed by Dr. Friedman as appendicitis. When I saw the patient his temperature was  $100.6^{\circ}$ , his pulse 99, and there was slight tenderness over McBurney's point. The abdominal walls were lax. In the right loin, tenderness was exquisitely marked, and at this site there was distinct bulging, over which deep fluctuation could be made out. At the time of this examination the urine was bright red in color, due to the admixture of a very large quantity of blood. An aspirating needle inserted into the bulging mass in the loin withdrew extremely foul-smelling pus. The result of the aspiration, the severe hæmaturia, the laxness of the abdominal walls, the minimal amount of abdominal tenderness, and the absence of marked gastro-intestinal symptoms, led me to make the diagnosis of perinephritic abscess due to primary renal disease. The patient was too septic at this time to attempt to determine the exact nature of the kidney lesion. The perinephritic abscess was opened and drained, and the patient returned to bed. He never rallied from the operation, dying eighteen hours later. A post-mortem examination disclosed a general diffuse purulent peritonitis, due to a totally gangrenous perforated appendix. The cæcum lay directly anterior to the right kidney, and the appendix was retrocæcal, lying upon the kidney. The entire perinephritic tissue, including the kidney capsule, was gangrenous, and the kidney was so intensely congested that it was a deep

blue-black in color. There were numerous infarctions of the kidney cortex.

CASE III.—I. T., 34 years old, seamstress by occupation. Family history negative. Ten years ago she had a profuse pulmonary hemorrhage and was told by her physician that she had tuberculosis. After a prolonged stay in a Northern resort she was pronounced cured. Present history dated back four months, the chief complaints being frequent painful urination, and continuous backache, with intercurrent acute attacks corresponding in every detail with the symptoms of renal colic. The patient stated that in one of these attacks three months ago she urinated pure blood, but that she never noticed blood in her urine before or after this. The day after her visit to the office she had an acute attack in which she experienced pain in the right loin, radiating down the right ureter. The pain was so severe that she fainted. Physical examination disclosed slight dulness over the apex of the right lung anteriorly, tenderness over the right kidney and along the course of the right ureter, and the presence of a faint trace of albumin and a few red blood-cells in the urine. There was an afternoon temperature of 99.5°. Tubercle bacilli were never discovered in the urine. Ureter catheterization was done by Dr. Johnson, with the following result: The bladder mucosa was normal, as was also the ureteral openings. A ureter catheter readily passed up the left ureter to the kidney. The right ureter was blocked at a point about two inches from the bladder wall. Even a stylet-armed catheter could not be forced by the obstruction.

These findings led to the thought that a ureter stone was causing the obstruction and all the other symptoms already detailed. Five X-ray plates made at three different sittings by Dr. Carman showed in each instance a clear-cut shadow in the course of the intrapelvic portion of the right ureter. Pain was persistent, excruciating, and incessant after the catheterization, and this symptom confirmed us in our belief that a stone had been dislodged from a fairly comfortable resting place.

At operation, the ureter was exposed by the iliac extraperitoneal route, from the kidney to the bladder, but no stone was found in it. At the site where the X-ray showed a shadow, the ureter was kinked as if pulled upward and inward. At the site of kinking there seemed to be a hard nodule resting on the

anterior surface of the ureter, and in order to determine exactly what this nodule was the peritoneum was opened. Through this opening we made out that an inflamed appendix containing a stony hard concretion was adherent to the anterior surface of the ureter. At the site of adhesion the ureter was pulled upward and kinked. Appendicectomy was done, the peritoneum sutured, and the wound in the soft parts closed around a drain. An X-ray picture was taken of the appendix immediately, and this picture gave a distinct shadow of the concretion. The appendix was then opened and found to contain a few drops of pus in its dilated tip, back of which there was a dense fecal concretion that had formed about a small seed with a hard chitinous capsule. (The seed was somewhat larger than the seed of a tomato.) The patient reported six months later that she was perfectly well.

Here then, are three cases, all of them encountered within a short period of time, and all of them characterized by the facts, first, that they were wrongly diagnosed by the operating surgeon, secondly, that pain radiating from the kidney region, and blood in the urine were prominent symptoms, and thirdly, that the lesion was in the appendix. By a strange coincidence this set of three cases establishes a basis for a rational classification of instances of hæmaturia complicating appendicitis. The first case was one in which no direct relationship could be established between the lesion in the appendix and the hæmaturia. Dieulafoy<sup>3</sup> asserts that there is an intimate relationship between acute appendicitis and nephritis, and he bases his assertion on the clinical observation that acute nephritis so often accompanies acute lesions of the appendix. The nephritis, which Dieulafoy calls "*Nephrite toxique appendiculaire*," is supposed to be due to irritation of the kidneys by the toxins resulting from the inflammation of the appendix. Dieulafoy states, furthermore, that the severity of the nephritis is in direct proportion to the acuity of the lesion in the appendix. Whether this last statement be true or not, it certainly is a fact, that acute appendicitis often causes an acute nephritis, and there is no reason for not believing that the inflammation of the kidney may result in the presence of red

blood-cells in the urine. Dieulafoy, in his paper, makes no mention of hæmaturia, but Hildebrand <sup>4</sup> in a paper confirming Dieulafoy's observations, records a case of acute appendicitis complicated by a well-marked hæmaturia. In this case, the hæmaturia disappeared after the acute inflammation of the appendix subsided, but reappeared with a second attack of appendicitis, finally disappearing for good, after the appendix was removed. Accepting, then, the views of Dieulafoy and Hildebrand, we may assume fairly that in our first case the hæmaturia was due to a toxic nephritis, secondary to appendicitis.

In our second case, the bleeding was due to a direct involvement of the kidney, as a result of the proximity of an acutely inflamed and gangrenous appendix, which had infected the perinephric fatty and cellular tissue.

In our third case we know that the ureter was kinked by an adherent appendix, but we cannot state positively just what caused the presence of blood in the urine. Possibly the kinking of the ureter caused a venous obstruction, and a consequent slight outpouring of blood from the ureteral mucous membrane. I can find in the literature only two other cases of appendicitis that caused marked urinary symptoms due to adhesion between the ureter and the appendix. These cases are reported by Lancien,<sup>5</sup> but he makes no mention of hæmaturia as a symptom.

Bearing our three cases in mind, we see how readily they lend themselves to the following classification: (1) Cases of hæmaturia due to the actions of toxins upon the kidneys; (2) cases of hæmaturia due to direct involvement of the kidney; and (3) cases of hæmaturia due to direct involvement of the ureter. If, in addition to the three cases reported in this paper, we examine the recorded cases in literature, we find one other source of hæmaturia complicating appendicitis. Cases are recorded in which the urinary bladder was perforated by an appendicular abscess, one of the symptoms of the perforation being blood in the urine. (Odde and Silhol,<sup>6</sup> Lancien,<sup>5</sup> Brun.<sup>7</sup>)

A complete classification of the subject therefore would have to be framed as follows:

Hæmaturia complicating appendicitis may be due to:—

1. General systemic invasion resulting from acute appendicitis, and affecting the kidney indirectly,—so-called toxic nephritis.

2. Involvement directly of one or more of the organs of the urinary tract.

a. Kidney, as in case 2 of this paper.

b. Ureter, as in case 3 of this paper.

c. Bladder, as in the cases recorded by Odde and Silhol, Lancien, and Brun.

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The recorded cases of blood in the urine of patients suffering with appendicitis are very scanty. There are no papers in English, French or German, that take up the subject by title; but the following papers all have a direct bearing on the subject.

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<sup>2</sup> Lannelongue. Importance of Toxicity of the Urine, *Jour. Amer. Med. Assoc.*, June 29, 1907, abstract.

<sup>3</sup> Dieulafoy. La Nephrite Toxique Appendiculaire, *Semaine Medicale*, No. 42, 1903.

<sup>4</sup> Hildebrandt. Ueber complizierende Nephritis bei Perityphlitis, *Mitt. aus der Grenz. Der Med. und Chir.*, B. 14, 1905.

<sup>5</sup> Lancien. Contribution a l'étude des troubles de l'appareil urinaire au cours de l'appendicite, Thesis Paris, 1902.

<sup>6</sup> Odde and Silhol. Complications urinaires de l'appendicite *Marseille Med.*, vol. 41, p. 431.

<sup>7</sup> Brun. Absces de la cavité de Retzius par Appendicite, *Presse Med. Par.*, vol. 4, p. 341.

<sup>8</sup> Johnson. *Med. Chir. Review*, New York, 1837, p. 197.

<sup>9</sup> Walther. Quoted by Odde and Silhol.<sup>6</sup>

<sup>10</sup> Moldowsky. *Ibid.*

<sup>11</sup> Boucheseiche. Contribution a l'étude des modifications urinaires dans l'appendicite, Thesis Paris, 1904.

NOTE.—Since the completion of this paper, an article has been written by Dr. Gray L. Hunner (*Jour. Am. Med. Asso.*, Apr. 25, 1908) emphasizing the importance of hæmaturia as a complicating factor in appendicitis.

## VOLKMANN'S ISCHEMIC PARALYSIS.\*

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ISCHEMIC paralysis, first described by Volkmann in 1880-81, is a comparatively rare lesion if one is to judge by the small number of cases in the literature. However, as its importance has been emphasized in the last few years, a rapidly increasing number of cases has been reported. In 1904, Schramm could collect only 27 cases. In 1907, Powers collected 52 cases, to which I am able to add 6 cases from the recent literature and one personal case which will be described later. In the last four years more cases have been reported than in the preceding twenty-four years, which is rather an index of the increasing interest in the subject, than of the greater frequency of the lesion.

In all but two of the 59 cases the forearm was involved (flexor muscles). The other two cases occurred in the flexors of the leg and foot. The great majority of cases occur in children from three to twelve years old. Their vessels are less mature and the circulation of their muscles is more easily disturbed. The underlying cause in all these cases is ischemia (or, better, oxygen-deprivation), which may be induced by direct compression of the vessels and muscles, or by contusion, laceration, thrombosis, or embolism of the vessels. These factors may be more or less combined. At least 80 per cent. of the cases reported have followed fractures where splints or plaster bandages have been too firmly applied. The fractures have involved the arm and forearm in about equal numbers; always the lower third of the humerus in the arm, and usually the middle of the bones in the forearm. Complete ischemia,

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\* Read before the New York Surgical Society, April 8, 1908.

persisting for more than six hours, is almost sure to be followed by serious contracture.

*Pathological Changes.*—At the time of injury, the circulation distal to the fracture is interfered with by the mechanical displacement of the fragments, and the effusion of blood which is greater than is usually supposed (Hildebrand). The artery may be narrowed, torn across, or thrombotic. At a later time the artery may be entirely obliterated for a considerable distance, as in Peterson's case. Too tightly applied dressings not only enhance the obstruction to the arterial supply but add the element of direct pressure upon the muscle-substance itself. How important a factor this direct pressure may be, is indicated by the formation of areas of pressure-necrosis and abscess in the proximal portion of the flexor muscles and skin of the forearm, where the pressure is greatest, in 60 per cent. of Schramm's cases. Riedinger believes the direct mechanical pressure upon the muscles is the important factor more often than interference with the arterial supply, since, in his four cases the area of muscle damage was exactly coincident with the pressure-area. In either case, if the pressure continues for more than six hours, the muscle substance rapidly degenerates, enters a condition of rigor mortis, and shortens, causing the typical deformity. When the pressure is relieved, there is marked effusion from the damaged vessels, and round-celled infiltration of the soft tissues. The muscle is more or less replaced by connective tissue according to the severity of the case. With the lapse of time the cicatrix becomes harder, shorter and the deformity more fixed.

Primarily the nerves may show no change, or may show degeneration as a result of the ischemia and pressure. Later, whether primarily involved or not, they may suffer degeneration from the pressure of the contracting cicatrized muscles, and this in turn results in atrophic changes in their muscle-fields. In the area of compression the nerves are often nothing but fibrous bands, while above, they are thicker and softer than normal from congestion. Sometimes they are nodular from irregular compression.

*The symptoms*, in rapidity of onset and severity, depend upon the degree of ischemia present and its duration. In the severe cases, the symptoms are prompt in appearance and very characteristic. Almost immediately after the application of the tight dressings the patient makes vigorous complaint of pain. If the splint is not promptly removed, the pain increases in severity, marked swelling occurs in the hand and fingers, together with purple discoloration and the formation of skin-blebs. Within twenty-four hours the hand assumes the claw-shape resulting from contracture of the damaged flexor muscles, and if the dressing be not then removed, necrosis of the skin and flexor muscles is very apt to occur a short distance below the elbow (60 per cent. of Schramm's cases).

On removal of the splint, the flexor muscles are very hard and board-like to the touch, and the extremity is in characteristic position. The elbow is slightly flexed, the forearm pronated, the wrist slightly flexed, and the fingers strongly flexed in the claw-hand position. When the wrist is extended as much as possible, the fingers cannot be extended by any degree of force short of that sufficient to break the bones or rupture the tendons. When the wrist is fully flexed, the fingers may readily be extended by passive motion, although in bad cases this extension may not be complete. When the wrist is extended the fingers automatically flex and cannot be prevented from doing so by any degree of resistance. All attempts at extension, in whatever position, cause the cicatrized muscles to spring into prominence between the internal epicondyle and the front of the wrist. In the severest cases the contracture is sufficient to drive the fingernails into the palm of the hand.

When the nerves (usually median and ulnar) are primarily damaged by the ischemia, there is loss of sensation and paralysis of the muscle-field, which is partial or complete, according to the degree of nerve injury. When the nerves are not primarily involved they are very apt to undergo degeneration from compression by the cicatrization of the muscles. In either case, when nerve damage is present, there will develop trophic changes (blue, cold, glossy, thin skin), and mus-

cular atrophy in the nerve-field, in addition to loss of sensation and paralysis.

In less severe cases the symptoms develop more slowly.

*Diagnosis.*—When, after the application of firm dressings to a fractured extremity, there appear rapidly and simultaneously, pain, swelling, discoloration, flexion-contracture of the fingers and wrist, with loss of power to extend them either actively or passively, ischemic paralysis is present. Paralysis due to nerve injury is very different. Here the muscles are flaccid, permit passive motion through the full range, and contracture when it does occur is late in appearing and slow in development. The characteristic features then, of ischemic paralysis, are the rapid and simultaneous onset of loss of function, flexor-contracture, and rigid resistance to passive extension.

It is important, both for purposes of prognosis and treatment, to determine whether the nerves have been involved either early or late in the process. If the muscle responds, even though very faintly, to both faradic and galvanic current, there is no nerve injury. If the muscle responds to galvanic but not to faradic current, there is nerve injury. If the muscle responds to neither galvanic nor faradic current, there is complete muscle injury; nerve injury not determined. In this last contingency help may be derived from the examination of the muscles of the hand (interossei, lumbricales, thenar and hypothenar groups) which are very seldom or never involved in the ischemic lesion. According to the reactions of these muscles, it can be determined whether or not nerve impulses pass through the damaged area above, and therefore whether the nerves themselves are damaged.

*Prognosis.*—The prognosis varies not only with the degree of muscle and nerve damage, but depends decidedly upon the promptness and energy of treatment. In general the prognosis is unfavorable. Where the muscle has been entirely cicatrized there is no hope whatever. When only a small portion of muscle has been involved, proper treatment may

result in complete or nearly complete cure. Between these two extremes there are many degrees of recovery.

*Treatment.*—Bearing upon the subject of treatment are certain important facts derived from experimental research. Lapinsky caused ischemia in dogs' legs by tying the chief arteries. If the collateral circulation was allowed to develop, power slowly returned in the paralyzed muscles without inflammatory reaction. When, however, blood was allowed to return rapidly into the vessels weakened by prolonged absence of oxygen, effusion, swelling, and interference with the return of power in the muscles occurred. Leser caused ischemia in dogs' legs by tight splints. When the ischemic contracture had developed, if the splint was removed and the dog allowed to run free, the muscles soon returned to normal condition. If the limb was immediately re-immobilized, whether with a tight or loose dressing, a permanent contracture developed. This means that activity of the muscle substance so improves its circulation and nutrition as to prevent the degenerative changes which follow continued immobilization.

Treatment, based upon the sequence of pathological changes and the results of experimental work, must be early and vigorous. The longer ischemic paralysis has existed, the more difficult it is to cure; in fact, other things being equal, the success of treatment varies almost inversely as the time elapsed since injury. The cicatrization of the muscles, which is the essential feature of the condition, becomes more complete the longer the contracture exists. Prophylaxis is most important. No tight primary dressing nor any form of treatment which would cause circulatory obstruction should be applied to any fracture, especially in children when it involves the region of the elbow-joint, for this combination of circumstances is present in 96 per cent. of the reported cases. In every form of dressing allowance must be made for post-traumatic swelling. Frequent inspection or report, at intervals of not more than four hours, should be insisted upon for the first twenty-four hours. The dressing should be promptly removed if the patient complains of increasing pain, or if

swelling or discoloration appear with or without beginning flexor-contracture.

In every case reported in the literature, the removal of the primary dressing has been followed by the application of another, which, while looser, has continued the immobilization of the muscles. In the light of Leser's experiments this is faulty treatment. Not only should the primary dressing be removed but massage, electricity, active motion if possible, vigorous passive motion, under an anesthetic if necessary, should be used to restore the circulation in the damaged muscles. During these procedures proper support should be given to the fracture by an assistant, and afterwards the extremity should be lightly bandaged to prevent too much effusion into the damaged muscles. These measures should be repeated every few hours until the muscles are in good condition again, when attention may once more be directed to the fracture itself. Even if this treatment should result in malunion, non-union, or pseudarthrosis, either of these conditions is much less troublesome and more easily corrected than an ischemic contracture.

After the condition is once present, there is a choice between non-operative and operative treatment. Non-operative treatment consists in baths, massage, electricity, and passive motion. Some authors advise repeated strenuous extensions of the wrist and fingers, under an anesthetic if necessary.

Martin (C.) reported a case in which continuous slow elastic traction gave a most satisfactory result in a comparatively short time.

Sayre (R.) recently showed a case (see bibliography) where a very good result was obtained after using mechanical extension for six months. In both these cases the contracture did not appear for some six or seven weeks after the injury and it would seem probable that not so much of the muscle substance was damaged as in the cases with more rapid onset. Therefore a favorable result might be expected.

In severe cases, where the circulation is more seriously

damaged, these mechanical appliances involve a degree of risk, for pressure sores occur upon slight provocation.

Non-operative treatment is tedious, difficult, and the majority of results reported are not satisfactory. It gives no relief to compressed nerves.

Operative treatment gives quicker and more complete results according to the statistics of the published cases. In many of the operative cases palliative treatment had been tried for long periods of time without result.

There are two operative procedures each of which has its advocates: Tendon-lengthening, in which the flexor tendons are elongated sufficiently to permit complete simultaneous extension of the wrist and fingers. Advantages—no shortening of the forearm; no chance of mal-union, non-union, or pseudarthrosis. Disadvantages—operation is tedious; tendons may become mixed, adherent to each other and to the skin cicatrix, thus limiting mobility; the nerves may be injured or divided and sutured by mistake to tendon, as has happened in some of the reported cases.

To minimize adhesions to the skin some operators make a U-shaped flap with the convexity upward.

Resection of both bones of the forearm was first advised by Henle in 1896. Enough (1.5 to 2 cm.) is removed to permit complete extension of the wrist and fingers simultaneously. (See appended case-history.) Advantages—operation is short; avoids adhesions of tendons to each other and to skin; avoids damage to nerves. Disadvantages—forearm is shortened; there is possibility of mal-union, non-union, or pseudarthrosis. (Non-union has been reported once.)

Both operations have given good results and both ultimately act in the same way by eliminating the deformity, increasing the range of passive motion, relieving the extensor muscles from overstretching, and placing the flexor muscles under conditions most favorable to regeneration. The ultimate result depends on the amount of muscle regeneration in the cicatricial area. The greatest stimulus to regeneration comes from voluntary contraction of such muscle as is left.

Both operations, by relieving the tension, not only favor such voluntary contraction, but greatly increase the circulation and nutrition of the muscle.

While tendoplasty has its warm advocates, most operators are turning to resection of both bones of the forearm because it reaches the same result by a shorter, simpler method. The danger of non-union is small, and the slight shortening causes no functional disturbance.

In every case presenting signs of nerve compression, whether primarily or secondarily, the nerves (median and ulnar) should be released. Freeman, who especially emphasizes the frequency and importance of nerve lesions in these cases, advocates transferring the nerves to a subcutaneous position, or excising some of the cicatrized muscle to allow more space for the nerve in its natural position.

When the flexor muscles have been completely changed to fibrous tissue, of course no procedure can cause regeneration. Since, however, it cannot be determined clinically when the muscle is entirely gone, no case should be denied the benefit of the doubt and refused the operation.

Even in cases which give no hope of the return of motor power, much can be done to relieve trophic and sensory disturbances by neurolysis.

In the report of the two cases involving the foot and leg, subcutaneous tenotomy of the flexor tendons relieved the talipes equinus and gave a useful leg, although flexor power was entirely absent.

In two cases in the forearm, tenotomy of the flexors was done at the wrist, with the result of making a better looking but perfectly useless extremity.

As soon as the tendons or bones, according to the operation done, have firmly united, baths, massage, electricity, and passive motion should be employed vigorously and systematically until function has been restored to the muscles. Active use of the extremity should be encouraged at the earliest moment.

The object of after-treatment is to cause absorption of

cicatricial tissue and regeneration of muscle tissue. In the case reported below, progress seemed to be materially aided by preceding the bath and massage by congestive hyperemia for one to two hours, and combining the inunction of mercurial ointment into the cicatricial area with the massage.

Hope must not be given up even if no apparent progress is made for months, as these cases are invariably tedious, especially when the nerves have been involved.

**CASE HISTORY.**—Louis K. fell and broke the lower end of the right humerus on May 5, 1906. He was 4 years, 9 months old. One hour after the injury a plaster splint was applied. The next day the extremity was very painful and the hand was swollen, cyanotic, and covered with large blebs. The pains gradually subsided. On the seventh day, when the splint was first removed, there was an abscess involving the skin and flexor muscles just below the elbow, and a well marked, rigid, flexor-contraction of the wrist and fingers. The abscess was treated and the splint replaced. After four weeks the splint was discarded and the abscess was still discharging.

For eight months massage, electricity, passive motion, and vibration were tried with absolutely no benefit. Then, January, 1907, thinking the trouble was due to inclusion of the musculo-spiral nerve in the callus, an incision was made over the nerve at the outer side of the elbow. The nerve was not involved. The previous treatment was continued until June, 1907 (13 months), when he was referred to me by Dr. S. A. Twinch, who was not, however, responsible for the treatment of the original fracture.

**Physical Examination.**—A boy, slender, blonde, and in good general condition. The right arm is freely movable in all directions at the shoulder. There is moderate convex deformity above the external condyle of the humerus, result of the old fracture, resembling gunstock deformity. There is a linear scar over the outer aspect of the elbow from the incision over the musculo-spiral nerve. Just below the elbow on the flexor surface is the scar of the old abscess, 4 x 2 cm. The hand is cold, blue, with thin, shiny skin, and with trophic disturbances of the finger-tips, as indicated by thickened, corrugated nails, and red, shiny skin,

showing a tendency to ulcerate, especially on the tips of the index and middle fingers. The forearm, wrist, and hand are rigid, with the wrist flexed about  $20^{\circ}$ , the metacarpo-phalangeal joints slightly extended and the remaining finger joints about half flexed. It closely resembles "main-en-griffe." An unyielding, rigid band runs along the flexor aspect of the forearm from the internal condyle of the humerus to the wrist, which becomes more prominent on attempting to extend the wrist and fingers, and evidently prevents such extension. This same band prevents full extension of the elbow. All the flexors of the fingers are apparently involved in this cicatricial mass.

*Active Motion.*—Absent in the wrist joint. Very slight power of extension at the metacarpo-phalangeal joints. The extensor muscles contract definitely but cannot overcome the flexor contracture. The musculo-spiral nerve is therefore undamaged. The fingers spring back to their positions instead of being drawn back by flexor contraction. The fingers cannot be flexed.

*Passive Motion.*—The wrist can be fully flexed and, when held in this position, the fingers can be fully extended on the hand. When the wrist is brought back to the limit of its extension, the fingers, *pari passu*, resume their flexed position and no amount of force can prevent them from doing so. When the wrist is held at its limit of extension, the fingers can be fully flexed but can be extended only very slightly beyond the position they naturally assume when left alone.

There is atrophy of the interossei, thenar, and hypothenar muscles, and this, together with the trophic changes in the fingers, indicates that both the ulnar and median nerves are damaged.

Operation July 6, 1907. Ether. A 10 cm. longitudinal incision was made over the middle of the forearm just below the elbow. The flexors, superficial and deep, seemed to be entirely fibrous. An incision was made through them to expose the median nerve. They were mostly fibrous tissue with a few muscle fibres scattered here and there. There was but little bleeding. The median nerve, beginning where it passes between the two heads of the pronator radii teres, was compressed, thin, and white for a distance of 5 cm. downward. Above this area the nerve was much thicker and more congested than normal, while below, it was about normal in size and appearance. The

nerve was freed and wrapped in Cargile membrane. The ulnar nerve was compressed but not so much as the median. It was treated in the same way. The muscles were lightly sutured with catgut and the skin closed with silk.

By the subperiosteal method, 2 cm. of each bone of the forearm was removed; in the ulna 5 cm., and in the radius 7 cm. above its lower end. Different levels were chosen to avoid possible difficulty from cross union, and also to make it easier to hold the bones in position. The bones bled freely.

With the bones thus shortened the wrist and fingers could be extended simultaneously and fully. The marrow canals of the bones were too small to permit the use of Elsberg aluminum tubes inside, so tubes just large enough to receive the bone-ends were fitted in subperiosteally, the bones slipped into them and the periosteum sutured over them with catgut. The skin was closed with silk without drainage. The extremity was put up on an anterior splint with the fingers and wrist fully extended. All the wounds healed by primary union.

*Post-operative History.*—August 24, seven weeks after operation, the bones are firmly united. There is a fusiform swelling over the aluminum tube on each bone. Splint was discarded. The wrist and fingers can be fully and simultaneously extended by passive motion.

October 30 (3 months, 24 days). There is some return of the flexion contracture of the wrist and fingers. Marked improvement in the warmth, color, and nutrition of the hand. The thumb can be adducted and slightly flexed voluntarily. The fingers can be slightly moved by the extensors, but flexed only by the interossei so that the distal joints extend while the metacarpophalangeal joints flex. Fusiform swellings still persist at the points of resection.

February 3, 1908 (7 months). The contracture at the wrist and fingers has slightly increased. The interossei and thenar muscles are distinctly less atrophied and the thumb can be slightly flexed and well adducted so as to firmly grasp things between it and the side of the index finger. The little finger can be slightly flexed. The index, ring and middle fingers can be flexed only at the metacarpo-phalangeal joints, by the interossei muscles. All the digits can be slightly extended voluntarily. The elbow can

FIG. 1.



X-ray picture taken nine months after operation for ischemic paralysis. 1. Site of resection of the radius, showing the aluminum tube still in the callus. 2. Site of resection of the ulna, showing the tube more distinctly and a larger callus. The perfect alignment of both bones obtained by using tubes is clearly shown.



be extended a little more than before operation. The cicatricial mass seems to have diminished a little in size and rigidity. The fusiform swelling over the radius has entirely disappeared; over the ulna, the swelling is much larger as the result of a fall a few days ago. (Fig. 1.)

March 6, 1908 (8 months). The swelling on the ulna is much diminished. The hand is normal in color, temperature, and trophic appearance of the skin, and the interossei, thenar and hypothenar muscles are evidently returning to their normal size. Voluntary extension of the fingers is stronger. There is slight flexion of the fingers apparently by the long flexors.

In this case the history was characteristic and the onset was sudden, as indicated by the appearance, within twenty-four hours, of swelling, cyanosis, and skin-blebs of the hand. Abscess of the flexor muscles indicated a severe case. Non-operative treatment was carried out vigorously and systematically for thirteen months with absolutely no benefit. Operative treatment was then tried as offering the only hope left, although this was small. After eight months, there is slight improvement in mobility of the wrist and fingers, the appearance of very slight power to flex the tips of the fingers, marked improvement in power and movement of the thumb, development of the interossei and thenar muscles, and the return of normal trophic conditions to the hand and fingers.

The greatest improvement has occurred in the last two months, so that there is much to hope from the future of the case.

*Summary.*—Ischemic paralysis is essentially a myositis resulting from prolonged absence from the muscle of oxygenated blood. Muscle substance is replaced by fibrous tissue in proportion to the severity of the case, with a corresponding degree and rigidity of contracture.

The nerves are frequently involved, either primarily from the ischemia and pressure, or secondarily from compression by the cicatricial mass. This form of paralysis occurs, nearly always, in the forearm after too tight dressings have been

applied to fractures near the elbow. The great majority of cases occur in children from three to twelve years old.

*Diagnostic Symptoms.*—Early onset of severe pain and swelling; simultaneous appearance of rigid contracture with the paralysis of the muscles, causing the characteristic “claw-hand.” The simultaneous appearance of the contracture with the paralysis differentiates these cases from palsies due purely to nerve lesions.

Severe cases may result from six hours of tight compression.

Evidence of damage to nerves should always be sought.

*Treatment.*—Prophylaxis is most important. No tight dressings should be used on any fractures, especially when they are near the elbow-joint in children. In all dressings allowance must be made for traumatic reactionary swelling. Frequent inspections of dressings must be made for the first two days after injury.

When the lesion occurs, dressings must be removed, the fracture neglected for the time being, and attention paid solely to the return of muscle nutrition and function.

*Non-operative treatment* consists in the use of massage, electricity, vigorous passive motion, etc. (so-called physical therapeutics).

*Operative Treatment.*—Lengthening of the tendons of the shortened muscles sufficiently to permit simultaneous extension of the wrist and fingers.

Resection of both bones of the forearm is a simpler and probably a better operation. Enough is removed to permit full extension of the wrist and fingers.

Either operation relieves the excessive tension and favors muscle regeneration.

In all cases damaged nerves should be properly cared for.

*After-treatment* consists of physical therapeutics and must be vigorously and systematically applied.

Prognosis is on the whole unfavorable; complete cure is rare; improvement often comes only after months or years of steady work.

Results are better the earlier and more vigorous the treatment.\*

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\* It was brought out in the discussion by Dr. Erdmann at the New York Surgical Society that the gradually returning contracture of the wrist and fingers was due rather to the growth of the bones of the forearm than to further contracture of the cicatricial mass of muscles.

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## RECURRENT DISLOCATION OF THE ULNAR NERVE.

REPORT OF A SECOND CASE CURED BY OPERATION.

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IN the ANNALS OF SURGERY for November, 1903,\* I reported a case of recurrent dislocation of the ulnar nerve cured by operation together with a summary of all operations reported up to that time, fifteen in number. The rarity of this condition and the small number of cases operated upon call for a report of every case. I therefore wish to give the history of a second successful operation and in addition to present a brief review of what has been written on this subject and of the cases operated on since my last paper was published.

The ulnar nerve rarely dislocates forward of the condyle of the humerus, whereas subluxation to the tip of the condyle is not infrequent. About 3 out of 200 cases will show dislocation of the nerve, but the cases in which this dislocation causes painful and disabling symptoms are much rarer. Subluxation almost never causes pain. I have been interested in this subject and have been on the lookout for such cases for the past nine years, during which time I have been on duty at least eight months of each year in a large clinic at the Massachusetts General Hospital. These two cases,—the one previously reported and the one reported below,—are the only ones which have come under my observation, and so far as can be discovered are the only ones in the records of this hospital.

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\* Report of a case of recurrent dislocation of the ulnar nerve cured by operation. With summary of previously reported cases.

The recurring dislocation of the nerve on flexion of the elbow may be a congenital or habitual condition which does not lead to annoying symptoms. In these idiopathic or non-traumatic cases the dislocation is seldom accompanied by sufficient symptoms to demand operation. If symptoms do appear they yield to palliative treatment in most instances. In the few cases operated upon only two have been the congenital or habitual forms; in all the other operated cases the symptoms have resulted from trauma. The kind and degree of trauma to the region of the elbow causing the lesion are various. Direct violence, such as contusion and hæmatoma of the soft parts, has been followed by recurrent dislocation; indirect violence, such as exercising on a parallel bar or throwing a snow ball, has been sufficient to tear up the fibrous structures normally tying down the nerve and permit of the abnormal mobility. Diffuse suppuration around the elbow also has been followed by dislocation.

The majority of the cases operated upon have followed more or less severe direct violence either from blows or falls. My first case struck the inner side of the left elbow violently against a post, without, however, any bony fracture, about a month before symptoms due to dislocation of the nerve appeared; my second case, reported below, followed a septic wound at the inner side of the elbow and an incision for drainage of a large collection of pus. A case reported by Croft was also that of a young woman with septic infection in the region of the elbow following an injury.

The characteristic symptoms are severe darting pain at the region of the elbow into the distribution of the ulnar nerve in the hand. Numbness and tingling in the inner fingers of the hand may be present all the time, but flexion of the forearm causes a severe shooting pain from the elbow into the fingers. In both my cases flexion and extension of the forearm caused pain referred to the internal condyle of the humerus and inner side of the forearm and the two inner fingers of the hand. There was no loss of sensation in the region supplied by the ulnar nerve, the strength of the hand

was good and there was no muscular atrophy. There was entire disability for any form of work necessitating the use of the affected arm.

It is the accepted theory of nearly all who have reported cases of this condition that the darting pain along the course of the nerve is caused by the trauma of the oft-recurring excursions or jumps over the tip of the internal condyle, and that in a comparatively short period of time pathological changes in the nerve and its sheath take place. In most of the cases operated upon the nerve was found to be distinctly enlarged and fusiform in shape. The only case in which a microscopic examination of the nerve structure has been made was in the case of Andrae, which was summarized in my previous paper. Acting on the theory that the dislocation was due to the excessive length of the nerve caused by stretching Andrae excised the fusiform enlargement and sutured the ends of the resected nerve together. Examination of the excised piece showed a typical neurofibroma with marked thickening of the nerve sheath.

For a complete review of the subject as well as abstracts of cases reported previous to 1903 the reader is referred to my previous paper, also to the articles by Poncet, Haim, Schwartz, Rosenbach, Jopson, and Cotton, references for which are given in the bibliography at the end of this paper.

My first case was that of a man fifty-two years old. He was operated upon in 1900. Dislocation followed a blow as stated above. He had been disabled for six months. At operation the groove back of the internal condyle, in which normally the nerve should rest, was filled by muscle-fibres,—evidently a portion of the triceps. The nerve could be easily moved about between the points where it emerged from the intermuscular septum and passed between the two heads of the flexor carpi ulnaris. It was fusiform in shape and as large as a lead pencil in its thickest portion. There was no strong band of fascia passing over the nerve, the so-called arcuate ligament. It was evident that at the original injury the fibrous and muscular structures back of the condyle had been torn

or ruptured and in the process of repair the bony groove had been filled up with muscle-fibres.

The groove was cleared and the nerve replaced and a flap from the triceps fascia sutured over it to the fascia covering the flexor muscles. I have heard from him within a few weeks, eight years after the operation. He has remained absolutely free from any of the symptoms and has been able to engage in his occupation as lumberman.

REPORT OF THE SECOND CASE.—M. H., a young Irish-American woman, twenty-two years old, single, domestic servant by occupation, was first seen by me early in June, 1906, in the out-patient department of the Massachusetts General Hospital. She was kept under palliative treatment for two months before it was decided to operate. Her previous history was as follows: In 1904 she had been an inmate of the hospital because of accidentally swallowing a large safety-pin. This was removed successfully by Dr. Algernon Coolidge. One year before she came under my notice she had received a small lacerated wound at the inner side of the right elbow, which became infected and suppurated extensively for weeks. She was treated for this in the out-patient department. Soon after the infected wound healed she began to be troubled by numbness and pricking sensations in the fourth and fifth fingers of the right hand and shooting pain along the inner side of the right forearm starting from the elbow and continuing into the fingers of the hand. These symptoms at first did not bother her to any extent when she kept the arm still, but any motion involving flexion of the forearm at the elbow started up the severe pain. She had had an operation for the relief of these painful symptoms, which operation, so far as could be found out, consisted of dissecting out the scar of the old incisions for drainage, presumably on the theory that the symptoms were due to pressure upon the ulnar nerve. No relief was obtained from this treatment.

It was evident that the attendants in the clinic considered her complaints of pain as feigned, and I was informed that she was an old hysterical case and everything had been done that could be done for her symptoms, which were doubtless imaginary.

Examination showed a well-developed and nourished young

woman not markedly neurotic in appearance or conduct. The pupils were equal and reacted normally. There was nothing abnormal found in the heart, lungs or abdomen. There was a slight enlargement of the thyroid gland. Knee-jerks were normal. The right elbow was held in semi-flexion. Motions of the joint were possible, both flexion and extension, but caused complaint of severe pain at the inside of the elbow darting along the inside of the forearm and into the hand. On the inside of the arm over the course of the ulnar nerve was a wide dense scar about four inches long. The lower end of the scar was about two centimetres above the internal condyle of the humerus. The scar was readily movable over the underlying tissues. The ulnar nerve could be felt, with the arm in extension, in its groove back of the condyle, upon flexion it dislocates well forward of the condyle. The nerve was evidently enlarged and could be felt to the upper and outer side of the scar on the arm and could be traced for at least an inch and a half further than in normal arms. Pressure upon the nerve back of the condyle, and also where it was exposed under the skin upon the arm, caused extreme pain at the site of pressure and referred pain into the fingers.

There was no disturbance in sensation in the ulnar distribution in the hand nor was there evident loss of strength in the hand or muscular atrophy. Because of the suspicion of neurasthenia in the case, although the symptoms and signs of nerve dislocation were sufficiently plain, I was persuaded to try palliative treatment for a longer time than usual. The arm was put on an internal right-angled splint for three weeks. While it rested on the splint there was no acute pain, but some prickling sensations and numbness in the fingers persisted. At the end of three weeks upon removing the splint there was just as much pain, both local and referred, upon pressure and attempts to use the arm caused severe pain. It was impossible for her to use a broom in sweeping or to do any household work which called for flexion of the forearm at the elbow. A second period of rest for three weeks made no change in the conditions. At the end of two months' palliative treatment I became convinced that this was a case of actual disability from recurrent dislocation of the nerve, and also that it was a case in which, because of extensive suppuration and previous operation, the nerve had even more freedom than is found usually. The movement of the nerve in the arm, as the forearm was flexed, was marked. Either by the suppuration or previous

operation the nerve had been freed from its normal place under the aponeurosis of the triceps and was subcutaneous for an abnormal distance. Accordingly I operated upon the patient on the 15th of August, 1906.

The old scar was dissected out and it was found that the nerve was exposed for a distance of about two inches above the groove in the condyle and at the point where it entered the aponeurosis over the triceps muscle it was bound down firmly by scar-tissue. Between this point and the groove it was enlarged, reddened and freely movable. The fibrous tissues normally pinning the nerve down into the groove behind the condyle were not defined, a condition which meant that with every flexion of the forearm the nerve was displaced forward over the condyle and also pulled upon at an acute angle where it emerged from the intermuscular septum.

The nerve was buried as nearly as possible in its normal position by making a new fibromuscular canal, suturing the nerve under the fibres of the triceps muscle and also turning over a flap from the aponeurosis of the triceps and suturing it to the fascia over the flexor group. The wound was closed without drainage and the arm put up on an internal right-angled splint. At no time after the operation was there complaint of pain. The splint was removed at the end of three weeks and active and passive motion begun without bad result.

I saw the patient over a year after the operation. She has been at all times free from pain and disability, has married and is able to do her own housework.

Emil Haim (Ueber Luxation der Ulnaris, *Deutsche Zeitschrift für Chirurgie*, Leipsic, 1904, lxxiv, 96) reported two case, one operated on by Lotheisen and one case of Von Hacker personally communicated to Lotheisen. a case operated on at the Innsbrücker clinic. Haim in common with certain other German writers discusses at some length the question of a predisposing cause in the non-traumatic cases. He thinks that the dislocation is never congenital and that a predisposition exists. He, as well as Cohn, advances a new theory which is worth mentioning, although it is hard to attach much importance to it as the cause of the dislocation. He places great

stress on the carrying angle at the elbow, that is, the angle which the forearm makes with the humerus in extension, the *cubitus valgus*, and he thinks it has been proved by a study of many patients that this angle is less in those cases in which the ulnar nerve dislocates. He found in men with normal ulnar nerves that this angle was from 170 to 178 degrees; in women 165 to 175. In the cases in which the subluxation or dislocation of the nerve was present the angle was about 5 degrees less.

The case of VON HACKER is of special interest because of the dislocation of the nerve caused by tuberculosis of the internal condyle. The progress of the disease pushed the nerve forward out of its normal position permitting recurrent dislocation with the typical pain and disability. After dissection of the epitrochlear glands and removal of some diseased bone, the nerve was sutured under a bridge of fascia, with an excellent result so far as the relief of the pain was concerned. No other details of this case are given.

LOTHEISEN's case was one of traumatic dislocation of the *right ulnar nerve* following a blow on the elbow. Operation and recovery. Two years after, operation on the *left nerve* for the same condition. School boy, sixteen years old. No previous trouble in the region of either elbow-joint. Five days before fell, striking on right elbow. Immediately felt severe pain in the elbow and darting pains into the two inner fingers of the right hand. The painful symptoms persisted.

Examination: Normal in every way except in regard to right elbow. The ulnar nerve could be felt as a distinct cord forward and inside of the epicondyle, and pressure on this cord caused severe pain at the elbow and into both inner fingers of the right hand. Upon extension of the forearm the nerve returned to its normal situation. It was noted that the left nerve was somewhat freely movable,—that is to say, there was subluxation. X-ray photographs showed that on both sides the epicondyles were normal and even larger than usual. On both sides there was a marked cubitus valgus. The measurement of the carrying angle was 165 degrees.

Operation December 15, 1902. Ethyl chloride anæsthesia. A straight incision over the internal condyle. The nerve appeared normal. It was placed in its groove and a flap of fascia sutured by four silk stitches to the periosteum and edge of the bone,—how is not stated. Skin wound closed without drainage. Arm put up on a splint in extension. After ten days some careful passive motion of the joint, and after fourteen days the arm placed upon a right-angled splint. At the end of three weeks the patient left the hospital without pain. Seven weeks after the operation he was well. (Note the early date at which motion of the elbow was attempted.)

A second operation was done by Lotheisen on this same patient on the other elbow July 14, 1904, about two years after the first injury. While at work suddenly felt a sharp pain in the left elbow and left hand exactly similar to what he had had on the right. By self-examination he noted that the nerve dislocated on each flexion of the forearm. Examination discovered typical dislocation as at the other elbow. A similar operation was done save that the flap of fascia was sutured over the nerve to the edge of the triceps muscle. No after-treatment or result is given, except that on flexion the nerve remained fixed in its normal position.

Rosenbach (Ueber die Luxation des Ulnarnerven, *Deutsche Zeitschrift für Chirurgie*, Leipsic, 1906, lxxxv, 300) from the polyclinic in Göttingen reported a successful operated case and gave a concise review of the subject. In regard to the frequency of complete dislocation he gives the observation of the following men: Raymonenq found no case in 300 persons; Kissinger, 1 case in 200; Haim, no case in 350; and Momberg found 23 cases in 116, all in soldiers. Subluxation of the nerve is not infrequent. Kissinger found this in about one-third of the cases.

In my previous paper I stated that in a series of 150 large and well-developed men I found only 1 case of complete dislocation, but that in over one-third of the cases subluxation was present. These subluxations are not infrequently bilateral and almost never cause painful symptoms. Almost all the German and French writers give a good deal of space to the reasons for complete dislocation of the nerve. The practical points are that there must be some predisposing reason for the dislocation in those cases in which traumatic causes can be eliminated. The connective-tissue fibres from the aponeurosis, the so-called arcuate ligament which binds the nerve down in its groove may be weaker and looser in some persons than in others. This may be a congenital defect or due to conditions of ill health or emaciation. The triceps muscle may be larger than usual and take its insertion lower down so that on flexion of the forearm there is more of the bulging of the muscle tending to push the ulnar nerve out of its place. Again the condyle of the humerus may be smaller and less prominent in certain individuals. Fortunately in all but two or three of the non-traumatic cases of complete dislocation no

operation has been necessary and in those cases in which temporary painful symptoms have been present these have yielded readily to palliative treatment. The serious cases, those demanding operation, are usually the ones in which some definite trauma is the cause, either a blow or some violent motion of the elbow-joint.

Report of ROSENBACH'S Case.—A strong woman, eighteen years old, after exercising on a horizontal bar noticed that she could not move her right arm at the elbow without great pain. Applied ice and iodine, and had massage. Wore plaster of Paris bandage for two weeks. On examination complete dislocation of the ulnar nerve was found, with characteristic pain.

Operation seven weeks after the first symptoms discovered that the nerve was enlarged and reddened. The nerve was fixed in its groove by the following method: The groove in the bone was deepened by a gouge before the nerve was replaced. After this a flap of fascia from the triceps was sutured over the nerve to the fascia over the insertion of the flexor group. His reason for gouging out the groove was that he was afraid it would require too great force to hold the nerve in place. No details of the after-treatment are given. The operation cured the patient.

HOLM, A. (Et Tilfælde af Luxatio traumatica nerv. ulnaris., Hosp. Tid., Kbenh., 1906, 4 R. xiv, 461-468), reported a case operated on in Poulsen's clinic in Copenhagen, November 28, 1905, as follows: Case of a carpenter, seventeen years old. At eight years of age had dislocation of the elbow; at end of half a year all motions good, no further trouble. Ten days before entering clinic while flexing the forearm was struck a blow which knocked the inner side of the elbow against a table. There was immediate characteristic pain at the elbow, shooting into the finger, with increasing pain and disability. Poulsen used a small flap from the periosteum as well as a flap from the aponeurotic structures, suturing over the nerve with catgut stitches. The arm was put in extension, fixation bandages. In three weeks nerve held firmly in place, joint motions normal. There was no more pain, but on extreme flexion of the elbow there was a slight grumbling sensation in the fingers.

G. Tisserand (Luxations du nerf cubital, Arch. gen. de méd., Paris, 1906, 1, 86-91) is opposed to this method, which covers the nerve with a periosteal flap. He thinks that in this there is danger of pressure on the nerve ultimately, especially in young persons, from proliferation of bone; the flap from the aponeurotic structures is all that is necessary. In this opinion I agree entirely.

BLANC and TISSERAND (*Un Cas de Luxation du Nerf Cubital*, La Loire Méd., St. Étienne, 1905, xxiv, 27-30) have reported one operated case as follows: Workingman, seventeen years old. Two months before in making a violent effort to lift a heavy weight from the ground, felt sudden pain in the left elbow at the moment of flexion of the forearm, "as if a nerve was torn." For the next month and a half each movement of flexion of the forearm caused pain which was not severe or disabling until fifteen days before operation, when the severity and the weakness in the hand compelled him to give up work. Nothing is said about the distribution of the pain into the hand at this time.

Examination: The region of the elbow showed no wound or abnormality when the forearm was extended. The motions of the joints were normal. In flexion it was noticed that when the forearm was brought to a right angle on the arm one could see in bold relief under the skin a cord jump suddenly from the posterior to the anterior face of the epicondyle. At this time the patient complained of lively pain along the internal border of the forearm and in the elbow-joint. Pressure on the displaced cord caused severe pain in the forearm, radiating into the ring finger and little finger. On palpation the groove back of the condyle was found empty. On extending the forearm the nerve was seen to jump back suddenly to its posterior position. There was no anæsthesia in the nerve distribution and no muscular atrophy. The electrical reactions were normal. The ulnar groove was filled with fibrous tissue. This was removed and the nerve put back in the groove and fastened by a small flap of fascia from the aponeurosis which was sutured to the triceps muscle. Skin sutured without drainage and arm fixed in extension. Union by first intention. No pain since operation at any time. (Note.—On the tenth day passive motion was made and the forearm put up in half flexion, and in eighteen days brought up to a right angle and at each change of position passive motion of the elbow-joint was done.)

The man was discharged cured December 20th, just a month after operation. All the movements of the forearm were free and without pain. The ulnar nerve remained in its groove. This patient had a persistent zone of hyperæsthesia in the distribution of the ulnar nerve along the border of the ring finger and the hypothenar eminence.

Up to 1904 only 15 operations for this condition had been reported. Abstracts of these cases together with a report of my first case were given in the previous paper, 16 cases in all. Since 1904 it has been possible to find only 6 additional cases with my second case now reported, bringing the total number of operations to 23. A study of these cases justifies the following conclusions:

Operation for this condition has every chance of effecting a cure. Only the severe cases, few in number and for the most part traumatic, need ever be operated upon.

Operation should never be undertaken for dislocation of the nerve alone, but only for the severe and disabling symptoms caused by the recurring dislocation.

The simple operation of replacing the nerve in its groove and covering it over with a flap of fibrous tissue from the triceps fascia will be sufficient to hold it firmly in place. More elaborate operations of chiselling the bone or dissecting up periosteal flaps are unnecessary.

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## THE OPERATIVE TREATMENT OF RECENT FRACTURES OF THE FEMORAL SHAFT.\*

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As a preliminary step in this undertaking, it seemed wise to determine as accurately as possible the range of discrepancy in the length of the lower extremities of normal adults.

It is generally believed that a difference of an inch or even more may exist in the measurement of normal limbs.

Accordingly fifty subjects were carefully measured for me by Mr. Sterling Bunnell, a senior student of the University of California, who submitted the following data:

The greatest discrepancy in any individual amounted to  $\frac{3}{4}$  of an inch (1.9 cm.).

Average discrepancy in 50 subjects proved to be slightly under  $\frac{1}{4}$  of an inch (.58 cm.).

Discrepancy exceeded  $\frac{1}{2}$  inch in 3 subjects (6 per cent.).

Discrepancy equal to .39 of an inch (1 cm.) in 10 subjects, 20 per cent.

Right leg longer than left 18, 36 per cent.; left leg longer than right 25, 50 per cent.; legs equal 7, 14 per cent.

Hence it appears that in dealing with thigh fractures discrepancy in length of normal limbs exceeding one-half inch is to be reckoned with in only six per cent. of all cases and that only in one per cent. of cases will the difference amount to  $\frac{3}{4}$  of an inch or more.

As a secondary step I formulated a circular letter embodying the following queries, which was sent to all members of the American Surgical Association and to other surgeons of this country and Canada:

1. What is your interpretation of the term "tolerable result" (*i.e.*, satisfactory functional result) in fractures of the Shaft of the Femur?

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\* Read before the Medical Society of the State of California, April, 1908.

2. What degree of shortening is compatible with satisfactory function?

3. Is a definite amount of overriding of fragments permissible from the modern standpoint?

4. Are you satisfied with the average results attained by conservative (non-operative) treatment?

5. Are you an advocate of operative treatment as a routine initiative measure?

6. In operative procedure do you employ wire, nails, screws, staples or such an appliance as Parkhill's clamp?

7. Do you regard the danger of infection as contraindicating the operative treatment of simple fractures?

8. Has it been your habit to secure X-ray evidence of end-results on fractures of the femur?

Ninety-two answers were received. The data obtained from this source will appear elsewhere under appropriate headings.

The motive of this paper is:

1. To determine finally, if possible, what shall be regarded as a satisfactory end-result in fractures of the femoral shaft.

2. To ascertain whether or not anatomical replacement, and permanent fixation of fragments by operative interference is justifiable from the standpoint of infection and of improved end-results.

It cannot be denied that results of conservative treatment in thigh fractures have not, as a rule, conformed to the high ideals which govern every modern surgical undertaking.

During the past two decades surgical activities have centred closely upon abdominal and visceral lesions, while interest and enthusiasm seem to have waned as regards fracture treatment in general. As a rule surgeons of acknowledged skill and broad experience have approached ordinary thigh fractures with a jealously guarded prognosis, a faintly cloaked confession of inability to restore normal relation and function; and, at the end, in a certain proportion of cases adroitly framed apologies for manifest defects or deformities have been too often a forced expedient.

In 1890 the American Surgical Association appointed a committee to determine what should be considered a satisfactory result in simple fractures of the shaft of the femur.

The committee was composed of the following well-known gentlemen: Dr. Stephen Smith of the University of New York chairman, Drs. D. Hayes Agnew, David W. Cheever, D. W. Yandell, Charles T. Parkes, P. S. Conner, Charles B. de Nancrede and Hunter McGuire.

Smith's report submitted in 1891 was based upon opinions sent in by thirty-five members and was sanctioned by the Association. It embodied an analysis and discussion of all points involved by the question at issue.

His conclusions, slightly abbreviated, are as follows:

A satisfactory result may be predicated when:

1. Firm bony union exists.
2. Correct axial relations are maintained.
3. Preservation of correct relations of the anterior planes of upper and lower fragments.
4. Shortening not to exceed one-eighth to one inch.
5. Lameness, if present, is not due to more than one inch of shortening.
6. When the conditions attending treatment prevent better results than those obtained.

The doctrines herein set forth have been almost universally accepted by surgeons in practice, and to a certain extent have been recognized by Courts in medicolegal procedures.

It is to be borne in mind that, in the opinion of most surgeons, "satisfactory result" is a very flexible term, applicable to widely varying conditions, while on the other hand, in every department of surgery, the exaction is for the nearest possible restoration of normal relation and function.

Bloodgood, of Baltimore, in a personal letter says: "Quite frequently with some shortening, due to overlapping or bending, patients are able to walk without special difficulty. I would call this a satisfactory result," and adds, "It is remarkable how good function may exist with a great deal of shortening, provided that axial relations are maintained."

Harry M. Sherman, of San Francisco, believes "the term 'satisfactory result' is capable of two interpretations; one for non-operative, the other for operative treatment," intimating that anatomical adjustment is more probable following the latter method.

My own feeling is that higher standards in fracture treatment should be maintained with a stricter compliance with anatomical requirements. *Nor do I fear, that in departing from traditions, we shall tread upon dangerous ground from the medicolegal standpoint.*

Since Stephen Smith set the pace, the science of radiography has unfolded many secrets affecting the status of fractures at all stages, and it is apparent that end-results which in former days did not challenge adverse criticism on the part of the patient, his friends or later professional attendants, are capable to-day of being shown to be, from the anatomical standpoint, faulty in the extreme.

Whenever the X-ray as an official aid is accessible, it has become an indispensable factor, and the documentary evidence from this source is valuable through every phase of fracture treatment.

With a large experience extending over a period of twenty-five years, I am free to confess, that without the aid of radiography, I am unable to determine with any degree of accuracy the status of many fractures at any time during the progress of repair. This is particularly true of fractures of the femur where fragments are deeply imbedded in muscular tissue, by which outlines are obscured and prominences are impossible of correct definition.

In fracture treatment the surgeon is confronted by three exactions: First, the re-establishment of normal relations (interlocking of fragments); second, maintenance of perfect alignment; third, avoidance of rotation. And it may be added that failure to meet any of these conditions upsets one's calculations as regards the other two.

Very many thigh fractures can be treated ideally under conservative methods. It is obvious that before operation is

to be considered, repeated and conscientious efforts at adjustment and permanent fixation must be made. Just as obviously, conditions attending certain fractures render them practically incorrigible from the standpoint of conservative treatment.

Von Bergmann refers to the accident statistics of Haenel as follows: of 121 fractures of the femur only 39 recovered fully. In 75 the injury was permanent with average loss of earning capacity of 28 per cent.

Fractures of the upper third of the femur are notably obdurate. Many years ago Erichsen stated that in fractures of the upper third of the femur results were invariably unsatisfactory.

In 1890 Allis, at the close of an exhaustive treatise upon "Fractures of the Upper Third of the Femur," makes this significant and manifestly too sweeping statement: "The conversion of a simple into a compound fracture offers the only means of accurate diagnosis, and the only method of rational treatment. Patients and surgeons who stop short of this must compromise with best results."

By the action of certain muscles the upper fragment is rotated outward and drawn upward, while other muscles acting upon the lower fragment separate it widely and assure overriding, rotation and deformity.

My own experience with fractures of the *middle third*, verified by repeated X-ray evidence, has convinced me that ideal adjustment is likewise difficult if not impracticable. Especially is this true of transverse fractures at this point. In several instances of this sort I have made repeated and conscientious efforts at securing apposition, and each time the radiogram through anteroposterior and transverse planes has shown wide separation and overriding.

I wish to emphasize that shortening to an appreciable degree in transverse fractures of the femur means invariably overlapping, a condition which my own standards do not tolerate; and further, that the nearest possible approach to anatomical reposition and correct alignment should be recognized as not beyond the requirements.

During the past two years I have treated conservatively four thigh fractures with the following results: one was positively intolerable because of overriding; two were imperfect but in the ordinary sense satisfactory; one was ideal.

Another consideration is of paramount importance. With overlapping, union is effected with far greater difficulty and at the expense of double the time required when anatomical replacement has been secured.

In my opinion, a very large percentage of all cases of delayed or non-union can be attributed to faulty adjustment.

It is true that untoward results will be manifest less often at the hands of men of supreme intelligence, men who are trained in the use of appliances and methods such as those of Bardenhauer.

I have gone over the volume on fractures by this distinguished author aided by the splendid illustrations which it contains, and I am strongly of the opinion that few patients would submit to confinement in a fixed position during a period of weeks or months.

Furthermore the matter of adjusting multiple traction appliances, exerting force in from two to six different directions simultaneously would involve the average surgeon in overwhelming difficulties.

Were it a fact that operations for the relief of impossible conditions, such as loss of function, persistent pain, delayed or vicious union were easily capable of correction by late operation, any argument for so bold a procedure as an initial operation would have less weight.

Long experience in dealing with this particular lesion, and frequent opportunities of inspecting and correcting unfortunate results, has led me to two conclusions:

1. That the so-called "tolerable" or "satisfactory" results are too often either intolerable or unsatisfactory; overriding of fragments, shortening sufficient to entail permanent limp, angularity and rotation are not rarities in surgical experiences.

Of 92 surgeons appealed to, 69 consider shortening per-

missible to the extent of one inch or more; while 19 limit the shortening to  $\frac{3}{4}$  of an inch and only 4 to  $\frac{1}{2}$  inch.

Appreciable overriding is considered permissible by 75; not permissible by 17.

These opinions, based upon experience, indicate strongly that standards of excellence are not in accord with modern ideals.

Arbuthnot Lane says plainly, "The frequent occurrence of mechanical disability must be known to surgeons generally. . . . It seems little short of ridiculous to read the statements of surgeons, that such condition is a rare sequence of fracture."

2. The operative correction of such conditions, after the lapse of many weeks or months, is to be regarded as one of the most difficult of all undertakings in the realm of bone surgery.

A long train of humiliating failures have attended corrective measures for the relief of unsatisfactory thigh fractures, and it is not strange that such operations are approached with hesitation or positively declined. The first requirement is a long deep incision to expose the deformity and enable the dissection to be carried entirely around it. Bone surfaces, firmly or indifferently united, are to be chiseled apart, following vaguely defined lines of cleavage. Extensive deposits of fibrous or bony material must be removed; often the latter, following the accidental distribution of shredded periosteum, reach far afield and must be torn from their lodgement along fascial planes or within muscle sheaths. The ends of fragments, having lost their original detail, are smooth and conical if not eburnated, and fixation is only possible after removal of more or less of their apices.

If many weeks or months have elapsed, muscles will have permanently contracted to a degree that will require shortening of the bone from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches. All this is to be followed by drilling fragments and placing of one or two wires, nails, or other appliances. He is a clever operator who can complete such a task in two hours or even more. Exten-

sive unavoidable mutilation of tissues, and further dislodgement of periosteum invite infection, interrupt wound repair and, in a liberal proportion of cases, ensure disaster.

The estimate of the dangers of sepsis in fracture operations in the minds of competent surgeons is as follows: sepsis was considered as either a serious menace or prohibitive by sixty-three; as not a contraindication by twenty-nine.

That these opinions are based very largely upon the statistics of corrective, *i.e.*, late, operations, there is little doubt as less than a score of surgeons appealed to were able to report initial operations while practically all have dealt with late conditions. Only 22 out of 92 conceded the propriety of initial operations and several of these have had no personal experience along this line.

Carlton P. Flint, of New York, writes that from September, 1906, to October, 1907, he personally inspected 834 breaks at the Roosevelt Hospital. There were 53 operative cases, of which 29 were undertaken after delay for corrective purposes. In something over two hundred fracture operations sepsis was a complication in but four. He believes in early operation where the following conditions prevail, *viz.*, all breaks either near the upper or lower ends or at the middle of shaft with great displacement or where efforts at replacement are futile.

In his excellent work on "Operative Treatment of Fractures," Arbuthnot Lane of London says, "In looking through text-books I find any number of reasons given for non-union of broken bones, the vast majority of which are, in my opinion, utterly without foundation. I have never seen one instance in which union would not have resulted if efficient operative measures had been adopted."

In *Progressive Medicine*, December, 1907, Bloodgood refers at length to fracture work as conducted in Vienna. Ranzi reports that of fifty cases operated in Von Eiselberg's Clinic only three or 6 per cent. were for fresh fracture. He emphasizes the dangers of sepsis, inclines to conservatism and contents himself with good functional results.

Bloodgood's comment is suggestive. "In my opinion the argument against immediate operation is not the risk of infection but that radical measures are not absolutely necessary."

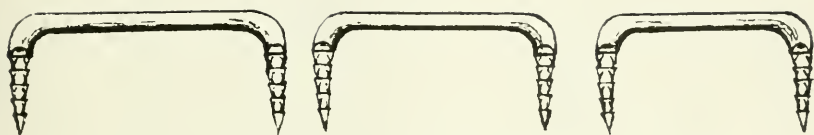
The materials heretofore used and at the present time widely in vogue for the purposes of fixation in fracture surgery are, to my mind, manifestly open to adverse criticism. All text-books with which I am familiar suggest, for this purpose, the use of chromic gut, kangaroo tendon, wire, nails, screws, plates, ferrules, or some form of complex apparatus such as the clamp of Parkhill.

I have long since recognized serious objections to wire or any similar material, for two reasons: First, lack of stability. After a careful adjustment of wire or tendon, it will be found that the slightest movement of the distal fragment will loosen the suture to such a degree as to admit of displacement. But the more glaring, and to my mind the fatal defect of the suture lies in the difficulty of its application. After having secured approximate replacement, the fragments must be again widely separated to admit of the introduction of the suture, first through a drill hole in one fragment from without inwards; thence through the medullary canal of the second fragment to complete the loop. This entails much loss of time and an added measure of traumatism to soft parts sufficient to ensure, in many cases, complications through infection. Furthermore wire is prone to break when twisted tightly.

In transverse fractures the application of the screw or nail is irrational and inefficient. The appropriateness of either in oblique fractures will be shown further on. Numerous authorities, notably Edw. Martin of Philadelphia, have written enthusiastically of the value of the screw and plate. To this I raise no positive objection further than it is difficult of accurate application and entails a somewhat complex technic.

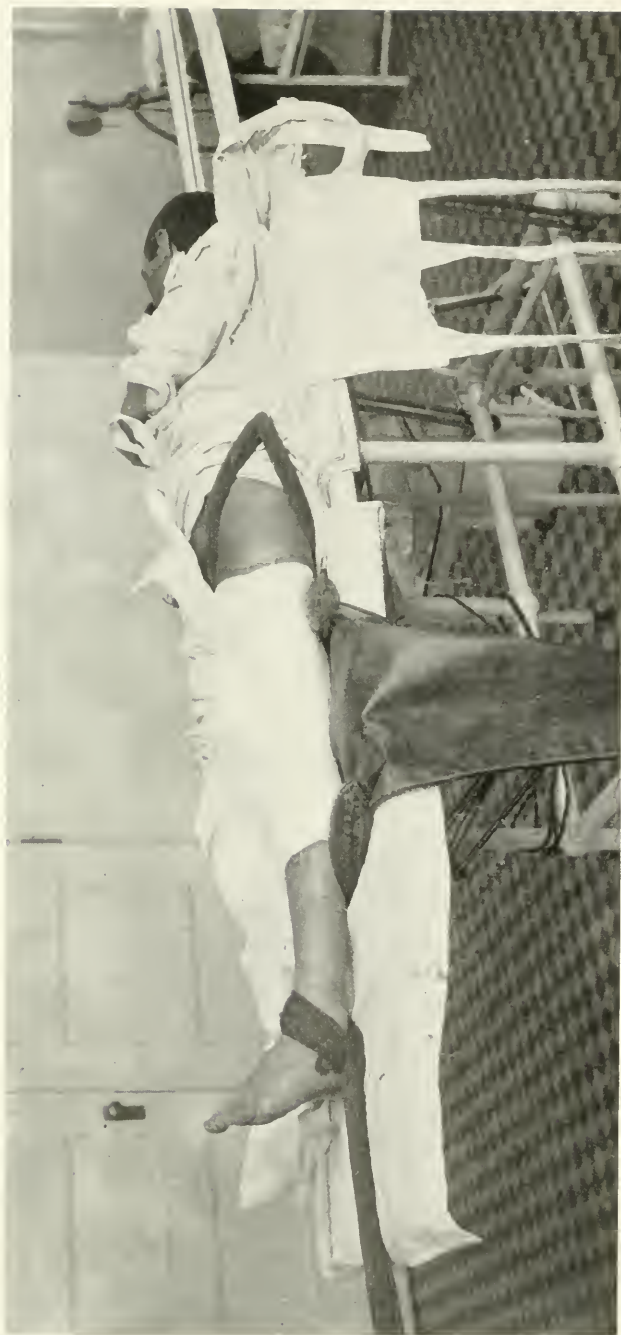
Ferrules have practically been abandoned, probably because of interference with bone nutrition at point of contact. Flint states that he has satisfactorily used a bone cylinder to be so placed within the medullary cavities of each frag-

FIG. 1.



W. ARBUTHNOT LANE'S STAPLES.

FIG. 2.



Traction apparatus for treatment of fracture of the shaft of the femur.

ment as to prevent displacement. The contrivance is certainly ingenious but when it is considered that the bone peg must be a recent specimen in order to secure ultimate absorption, that it must be of proper diameter and that its adjustment involves a complex procedure, it will probably not appeal to most surgeons.

The principle of the clamp involving protracted exposure to infection through metal cylinders, reaching from the bony fragments through the skin into the outer world, to be engaged in a horizontal bar has been elaborately set forth by Lambotte of Brussels. The apparatus, for obvious reasons, does not appeal to me. It seems to me cumbersome and awkward in the extreme and, entirely aside from the evident menace of sepsis, which I associate with it, I feel confident that the steel staple is a far simpler appliance, and will ultimately supplant it.

W. Arbuthnot Lane of London has repeatedly called attention to the value of the steel staple as a substitute for other fixation material wherever it is applicable. He employs a modification of the staple as devised by Dr. A. Jacoel. (See Fig. 1.)

Lambotte also has employed staples of slightly different type, with three or four legs which will probably be found valuable in comminuted fractures, particularly of the epiphysis.

Rixford reports employment of staples six times on five patients and Sherman four times without an infection. I have used staples in one and wire in five cases. Infection in one of the latter ended in a barely tolerable result.

In dealing with the technic of operative treatment of simple fractures of the femur, I have emphasized the necessity of simpler methods and more efficient fixation. A distinct advantage lies in making provision for systematic mechanical traction which will ensure reposition of fragments without undue violence to soft tissues after exposure of the parts.

The apparatus used at the University Hospital is illustrated in Fig. 2. Its details were worked out and exemplified by Dr. Harry M. Sherman and those who have had the oppor-

tunity of observing it in use regard it as indispensable. This is but the new application of an old principle and has possibly been used by others, though I find no allusion to it in the literature.

A skein of heavy woolen yarn is passed over each leg to serve as a medium for perineal traction. To each of these is attached a cord whose distal ends are tied to a ring in the end wall of the room. Another similar skein is applied to the ankle of the affected limb with a clove hitch. To this is attached a small set of pulleys which, in turn, are anchored to the wall at the foot of the operating table and the pulley rope is intrusted to an assistant.

Under the most careful aseptic precautions a comparatively small incision will suffice to uncover one or both ends of fragments. At this point the value of the traction apparatus is clearly apparent. The fracture being a recent one, no elaborate dissection is requisite. Having identified the line of fracture, traction by the pulley exerted upon the overlapping bones serves to bring the lower fragment slowly downward until it is capable, by external pressure upon both fragments, of being placed in exact axial relation. If the fracture be transverse or nearly so, slight relaxation of tension will serve to interlock the fragments. The operation now becomes delightfully simple. With the fragments interlocked, rotation being avoided, a drill hole is sunk in each fragment from  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch from the fracture line, the interval being determined by the length of the staple to be introduced. The placing of the staple is materially aided by the use of an ordinary carpenter's nail set, each limb of the staple being gently driven into the corresponding drill hole. We now have the fragments firmly united in exact anatomical relation by an unyielding steel splint. If the fracture be oblique or spiral the traction principle is alike applicable. Exact reposition being thus obtained, maintenance of proper relations is secured. In these cases the staple may or may not be found available. If the conditions are such as to throw a doubt upon the efficiency of one or more staples applied at each end of the

FIG. 3.

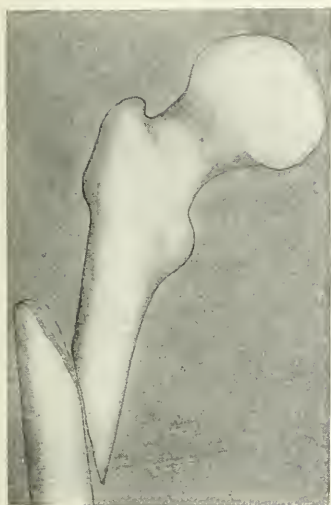
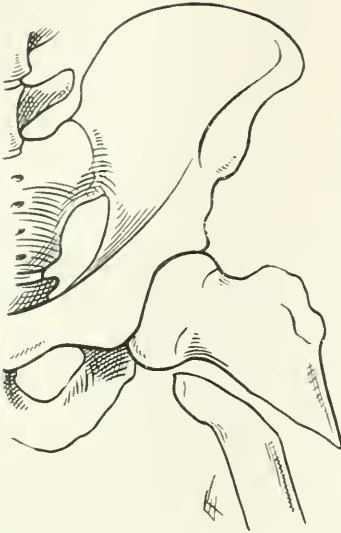


FIG. 3a.



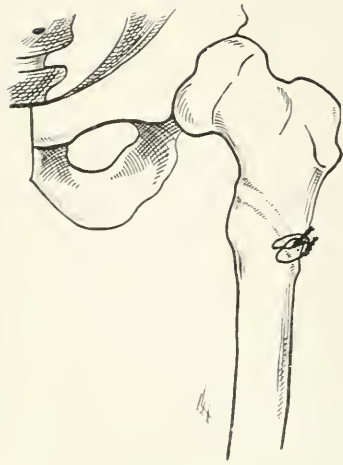
Skiagram tracing, showing original condition and end-result after wiring.

FIG. 4.



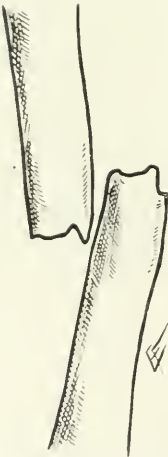
Subtrochanteric fracture of femur with marked displacement. (Tracing from skiagraph.)

FIG. 4A.



End-result obtained by wiring in case shown in Fig. 4. (Tracing from skiagraph.)

FIG. 5.



Before operation. Lateral view. Pseudarthrosis, with crippling deformity.

FIG. 5A.

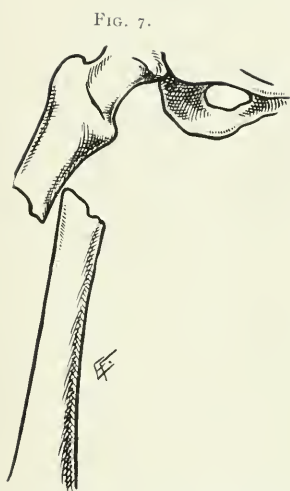


After operation.

FIG. 6.



Showing end-result in a recent fracture treated with wire and staple. (Tracing from skiagraph)



Figures 7, 7A and 7B, showing original condition, status after several efforts at adjustment and end-result after application of staple, with slight lateral bowing. (Tracings from skiagraphs.)

FIG. 8



Showing end-result after use of staple in a transverse fracture.

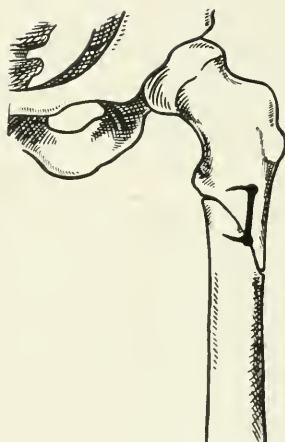
FIG. 9.



FIG. 9A.



FIG. 10.



Figures 9 and 9A, showing overlapping associated with non-union, at the end of sixteen weeks. Good union secured in five weeks, after use of staple, without shortening. (Tracing from skiagraph.)

Showing oblique subtrochanteric fracture ten days after use of staple.



fracture line, a single steel screw of the proper length and calibre may be used as a substitute. By it the permanency of adjustment may be absolutely assured.

Closure of the wound merits a passing word. A continuous catgut suture should be applied from the deepest layer of soft tissues outward so as effectually to obliterate the dead space overlying the fracture line and staple.

Drainage, in cases where there is extensive oozing, is probably a safeguard, but in the average case I believe it is to be omitted on the ground that it affords an avenue of ingress for infection.

The wound, having been carefully protected by a gauze dressing and before pulley traction is wholly released, a plaster of Paris spica is applied from the lower leg to the waist line.

To avoid slight curvature at point of fracture as has occurred in several instances, it is best to employ permanent traction apparatus for a period of a week or ten days succeeding operation.

#### CONCLUSIONS.

1. The term "satisfactory result" is too elastic and does not conform to any standard.
2. The two plane radiogram when available affords the most reliable diagnosis, and determines the plan of treatment.
3. The possibility of infection is not a prohibitive menace.
4. Operative wounds are less susceptible to infection in initiative than in late corrective procedures.
5. Approximate anatomical reposition is essential to quick repair and ideal result.
6. In oblique fractures slight overriding is permissible.
7. In transverse fractures appreciable shortening is due to overlapping of fragments, and is incompatible with good surgery.
8. Mechanical traction during operation is indispensable.
9. Steel staples (or screws in oblique fractures), because of ease of adjustment and efficiency, have proven superior to other methods of fixation.

## REDUCTION OF SUPRACONDYLOID FRACTURE OF HUMERUS,

(EXTENSION TYPE) BY PRELIMINARY HYPEREXTENSION OF THE FOREARM,  
AND MAINTENANCE OF THE REDUCTION BY EXTREME FLEXION.

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*Method of Reduction.*—In this connection attention is especially directed to the layer of periosteum (Case I, Fig. 1) stripped off from the posterior surface of the upper fragment for some distance above the seat of fracture, which at the same time remains attached to the posterior surface of the lower fragment, thus forming a hinge on which the latter can be swung forward and backward and turned upward and downward. This anatomical condition is pictured in Scudder's "Treatment of Fractures." It is the object of this paper to demonstrate that this periosteal attachment between the fragments is obviously the active deterring influence in the reduction of this fracture. Since the lower fragment as it swings backward on the periosteal hinge describes the arc of a circle, there must be a tendency, though slight within so small an arc, for the posterior edge of this fragment, which is the line on the latter from which the periosteal hinge takes its departure, to become raised to a higher level than it was in its normal position. With the position of the lower fragment, thus influenced by this restraint on its posterior border, it can be seen that any manipulation which tilts the anterior edge of this fragment upward, as flexion of the forearm, tends to lock the fragments together, thereby obstructing reduction, while a manipulation tilting the front of the lower fragment downward, as would be produced by hyperextension of the forearm, would throw the fractured surfaces apart at an angle which

opens anteriorly, and at the same time would relax the periosteum behind, thus unlocking the fragments and placing them in a position favorable to reduction. In this position of hyperextension the lower fragment can, with a little downward traction, be swung unobstructedly forward until the loosened periosteal layer comes again into its normal relation against the posterior surface of the upper fragment, when flexion of the forearm will tilt the anterior edge of the lower fragment upward, thereby completing the re-establishment of the normal bony relations. The test of having obtained a complete reduction of the deformity, unless interfered with by swelling, would be the ability to secure extreme flexion of the forearm.

*Maintenance of Reduction.*—After the fracture has been reduced the periosteum behind will prevent forward displacement of the lower fragment, while the position of extreme flexion of the forearm prevents forward riding of the upper fragment by the pressure exerted on the latter by the parts within the flexure of the elbow. Fig. 2 of Case IV shows how the coronoid process can come against the anterior margin of the upper fragment in extreme flexion and hold it in place. The proposition is herewith advanced that *extreme* flexion of the forearm is essential in order to maintain complete reduction, since otherwise pressure is not brought firmly against the front of the lower end of the upper fragment. Swelling at the outset may interfere with getting the amount of flexion necessary to maintain a complete reduction. A thin layer of absorbent cotton is placed between the skin surfaces at the flexure of the elbow to prevent irritation, besides which no constricting or compressing agent is introduced at this situation. Then the skin surface of the extremity is protected with a flannel bandage and a plaster of Paris splint is applied. The plaster bandages pass first circularly around the wrist and the upper part of the arm, encasing each singly, and then around both together down to the elbow (Case III, Fig. 3). The former turns prevent the splint from dropping off, the latter maintain the flexion. Neither flannel nor plaster

bandage should pass across the flexure of the elbow, as this would destroy the position of extreme flexion. In the literature on the subject Broca<sup>1</sup> commenting on the method of treating this fracture in the extended position as advocated by Berthomier<sup>2</sup> and by Laroyenne, states, "The fracture can with certainty be reduced by traction in the extended position with direct replacement from before backward . . . since this completely overcomes all muscular action." Both Broca and Scudder favor treatment in the acutely flexed position. Scudder, in the legend of an X-ray plate showing the deformity of this fracture, says, "It is often impossible to reduce this fracture without incision."

*Cases.*—The important features are indicated in the legends of the illustrations. The first case was one with tremendous swelling. Several attempts at reduction were made before the final partial reduction was secured on the 20th day (Case I, Fig. 3). In one of these attempts, where strong traction was made with a bandage in the flexure of the joint while the forearm was forced into flexion, an evidence of the periosteal hinge being a deterrent factor to reduction was demonstrated by the X-ray of the result which showed that the lower fragment had been tilted backward and the lower end of the upper fragment was in relation with its anterior surface. Early in the history of this case the great swelling precluded the employment of acute flexion in maintaining the fragments in reduction. The other three cases were all reduced by hyperextension preceding reduction, the forearm in each case could be readily brought up into forced flexion in which position the fracture was set in plaster, and all three cases had excellent results. Case IV was the only one not set under anæsthesia.

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<sup>1</sup> Leçons Clinique de Chirurgie Infantile, p. 93.

<sup>2</sup> Congrès français de Chir., 1875 and 1888.

FIG. 1.



CASE I (1). Age 11. 12th day. Condition before attempted reduction. A linear shadow indicates the situation of the periosteum stripped from the posterior surface of the upper fragment for some distance above the seat of fracture, and at the same time remaining attached to the lower fragment. *The primary relaxation of this periosseal hinge by hyperextension of the forearm is essential in the reduction of this fracture.*

FIG. 2



CASE I (2) shows result of attempted reduction 14th day, by holding the forearm at a right angle and then with downward traction on the condyles pressing backward on the upper fragment and forward on the olecranon process. *The tension of the periosteal hinge unrelaxed by this position of the forearm had held the fragments locked in the position of deformity, thereby preventing reduction by this manipulation.*

FIG. 3.



CASE I (3) Shows partial reduction, 20th day. With the forearm hyperextended the lower fragment was readily pressed forward and the forearm then came up into acute flexion with perfect ease. *Having previously failed to secure reduction in this case without hyperextension of the forearm, the efficacy of this method would seem to have been herewith demonstrated.* An iron spring and felt pads were relied upon chiefly to maintain the reduction, the forearm being thereby held in acute but not extreme flexion. The subsequent three cases demonstrate the possibility of maintaining a more perfect reduction simply by the position of extreme flexion.

FIG. 4.



CASE I (4) Shows result after  $5\frac{1}{2}$  months. Forced flexion. Acute flexion could be gained by force for about fifteen months, subsequent to which an obstructing callus developed. Forced extension would bring the forearm quite a little below a right angle.

FIG. 5.



CASE II. Age about 5. X-ray showing result  $3\frac{1}{2}$  months after setting by hyperextension of forearm with downward traction on condyles and forward pressure on the lower fragment and then bringing the forearm into extreme flexion. Some swelling at the time of setting. *Result:* Lacks about three degrees of full extension, otherwise perfect motion.

FIG. 6'



CASE III (1). Age about 6. Original deformity.

FIG. 7.



CASE III (2). Fracture reduced by the hyperextension method, and set in plaster in the position of extreme flexion. After making three or four unsuccessful efforts at reduction, the lower fragment finally slipped forward with a little snap and the forearm came easily up into extreme flexion. *Result*: Perfect motion.

FIG. 8.



CASE III. (3) Plaster of Paris splint holding forearm in extreme flexion.

FIG. 9.



CASE IV (1) Age 60. Original deformity.

FIG. 10.



CASE IV (2). Fracture reduced by the hyperextension method, and set in plaster in the position of extreme flexion. The X-ray shows how the coronoid process in this position of the forearm, by impinging on the anterior margin of the upper fragment, can influence the maintenance of reduction. *Result:* 7 months after removal of the plaster the patient wrote that his arm was "all right."

## TWENTY-FIVE HUNDRED CASES OF GAS-ETHER ANÆSTHESIA WITHOUT COMPLICATION.\*

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THE recent inroads of surgery into the domain of medicine have not only largely increased the number of operations, but have introduced so many extensive proceedings requiring prolonged anæsthesia that the problem of the administration of anæsthetics has been raised from a comparatively trivial to an important position. The surgeon fully realizes that to a large degree his success depends upon his anæsthetist, that many a skilfully performed operation has been rendered useless by clumsily administered ether and that many a convalescence has been unduly prolonged by over-anæsthetizations. Still the progress of this art has not been commensurate with surgery's advance. We still see, too often, patients profoundly shocked and deeply cyanosed in the hands of inexperienced men—perhaps in those of an obliging practitioner, entirely incompetent to take this important duty upon his shoulders. To a certain extent the text-books are responsible for over-etherization. It is usual to find the statement that surgical anæsthesia requires the absence of all reflexes. This is obviously erroneous teaching and leads to gross over-use of the drug.

A glance at the records and statistics of spinal anæsthesia suffices to show that at this stage it has not approached the usefulness of general narcosis. The mortality is variously estimated at from  $\frac{1}{10}$  to  $\frac{1}{2}$  per cent. Failure to produce anæsthesia occurs in 4 per cent. of cases according to Bier, 14 per cent. according to Moynihan, 10 per cent. according to

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\* Read before the Philadelphia Academy of Surgery, April 6, 1908.

Doderlein, etc. The after-effects are likewise more severe, 10 per cent. suffering from severe persistent headache; many have paralysis; nausea and vomiting is not infrequent. Rigidity of the muscles of the neck has been observed many times as well as untold more unusual complications.

An attempt to collect statistics as to postoperative complications and mortality from ether anæsthesia, showed a lamentable absence of records, both in the literature and hospital reports. In three of our leading hospitals no statistics whatever could be collected—in a fourth a list of 1800 cases was traced, with 18 cases of pneumonia, thirteen of which were fatal, giving a percentage of 1 per cent. of pneumonia and of .7 per cent. mortality. This is unusually high; which fact can be partly explained by the type of cases brought to this institution. As in many others, anæsthetization in *this* hospital is the duty of the junior resident, who is usually inexperienced. It is therefore a more or less fair example of statistics of etherization and its mortality in the hands of unskilled men, especially as these records do not show deaths from any of the other complications of ether anæsthesia, such as renal failure, acute cardiac dilatation, apoplexy and shock.

The present series of twenty-five hundred cases without serious complications and absolutely without pneumonia or bronchitis forms therefore a marked contrast.

A word as to what should constitute a complete surgical anæsthesia. It is that degree of sensory and motor depression required to enable the surgeon to complete his operation unhampered by movement or rigidity of the patient's muscles, and not one whit more. From this definition it obviously follows that the degree of anæsthesia varies with each operation and each individual, which fact the competent anæsthetist keeps constantly in mind. The signs and symptoms of sufficient narcosis vary likewise.

In a general way it may be said that complete surgical anæsthesia is indicated by a pupil reacting sluggishly to light, a regular noiseless breathing, a good color, muscular relaxation and absence of cutaneous reflexes. The best guide is the

pupil, but unfortunately in from 85 to 90 per cent. of cases it is not reliable during the whole time of narcosis. We find irregularity, inequality, absolute fixation of one or both pupils, etc., etc., in the above percentage of cases. This sign failing the respiration furnishes the best gauge. Close observation of the rhythm, the depth and the sound of breathing will almost invariably indicate the return of reflexes. The irritating vapor causes reflex contractions and consequently a more noisy, more hurried or more spasmodic breathing. Often the alteration is ushered in by one deep inspiration.

It is rarely necessary to carry the anæsthesia beyond a point where slight reflex inhibition of respiration is occasioned by administration of fresh ether.

To keep the patient on the borderland between consciousness and unconsciousness requires the absolute concentration of the anæsthetist. The subject's degree of narcosis varies from minute to minute. It is impossible to watch the details of the operation, or do anything but observe the changes in the patient's condition. It is much easier for the etherizer to carry the anæsthesia into the deep third stage with absolutely fixed dilated pupil, shallow respiration, cyanosis and increasing pulse rate. He then may follow the operation for minutes at a time or otherwise amuse himself, but he does so at the expense of the individual temporarily in his care. Ether is an irritant depressing poison, and each drop needlessly administered increases the danger to the patient's life, and decreases his power of resistance, so sorely needed in his period of convalescence.

In my hands the best results have been obtained by the use of nitrous oxide as a preliminary, followed by the gauze drop method. This has the following undisputed advantages: Nitrous oxide is by all means the safest anæsthetic we have, a series of 300,000 cases without a single death having been recently reported. It is not irritating and therefore greatly enhances the patient's comfort. All the choking, gagging and struggling so often seen where ether alone is used is eliminated. It greatly reduces the length of time required to

produce surgical anæsthesia, the average being from seven to eight minutes, and likewise greatly reduces the amount of ether required. This is especially true, as it is a well-known fact that it often requires as much, or more ether to anæsthetize a patient as it does to keep him under its influence for a considerable length of time. Its disadvantages are: nitrous oxide requires a more or less bulky apparatus, it is expensive, and in about 50 per cent. of cases, principally males and children, leads to an increased secretion from the respiratory mucous membrane. This last disadvantage would be an objection indeed had we no way to prevent, or at least to limit it. The most efficient preventative is the administration of a hypodermic injection of a full dose of morphine and atropine twenty minutes before the anæsthesia is commenced. This has many uses. The morphine quiets the patient, and to some extent depresses the nervous system so as to limit the amount of ether required. The atropine controls mucus secretion. Preliminary sprays of adrenalin and cocaine solution are also of some use. A thorough spraying of the mucous membrane of the nose and throat furthermore eliminates the rare danger of reflex cardiac inhibition occasionally observed as the result of the first administration of ether. If mucus is secreted in excess, notwithstanding these preliminary precautions, great care is necessary. Under no circumstances should such a patient be deeply anæsthetized—never to the point where inhaled mucus ceases to cause a reflex cough. The common practice of swabbing out the mouth and throat by gauze or other sponges is worse than useless; mucus reappears in less than two minutes and the friction of the sponges increases the flow. Raising the patient's shoulders allowing the head to extend fully while placed on its side allowing the mucus to flow into the cavity of the cheek thence leak out at the angle of the mouth, is the best treatment for this condition. Occasionally repeated sprayings and another dose of atropine helps to control the ceaseless flow.

As to the administration of ether itself the open method, and the most open one, namely, gauze, was invariably used.

Pads about four by five inches and about eight layers in thickness form the most convenient method of administering the drug. The concentration of the vapor may be regulated by the number of layers of gauze employed. Sixteen is about the average number, children requiring less, women less than men, the latter frequently calling for twenty-four layers. If great concentration is required the ether may be dropped upon the under gauze and then covered by an overlaying pad, which will practically exclude the air. More ether is required by the gauze than by any other method, the average amount for men being seven to eight ounces for the first hour, five or six for women. After this time the amount is greatly reduced, especially if a morphine preliminary has been employed, it not being an unusual occurrence to have thirty minutes elapse without the necessity for more vapor. Average amounts of ether required per hour are of no value statistically inasmuch as they vary so greatly with the individual.

If the anæsthetist observes the precautions cited above he will be enabled to carry on his narcosis without endangering the patient's life from over-etherization, which may lead to shock, inhalation pneumonia, kidney complications and great physical depression, reducing vital resistance and healing powers during convalescence.

The management of a so-called difficult case often taxes the ingenuity of the most experienced. Every one knows that notwithstanding the greatest care and knowledge it is sometimes impossible to completely relax some individuals. The type occasioning these difficulties is usually the fat, flabby, plethoric, short-necked male, addicted to the use of alcohol, whose mucous membranes are in a constant state of congestion, and whose arteries are sclerotic. This class of patients run great danger from complete ether narcosis. Their resistance is low, hence pneumonia is more likely to follow inhalation of infected mucus, almost always profuse in these cases. Their arteries are brittle, hence subject to apoplectic rupture, caused by the cyanosis so often the result of the early administration of ether. Their kidneys are, as a rule, impaired

and therefore likely to suffer from the anæsthetic, best results in these cases were attained from the following precautions: Twenty minutes before the anæsthesia a very full dose of morphine and atropine is injected hypodermically, the chest is covered by a cotton pneumonia jacket. Immediately before administration of ether, the mouth, nose and throat is thoroughly sprayed with a 2 per cent. eucaïne solution. Then a mouth-gag of the Whitehead type is inserted and the preliminary nitrous oxide commenced. When the patient is unconscious, ether is substituted in moderate concentration,—about sixteen layers of gauze moistened with ether being sufficient. At this stage frequently the patient spasmodically and reflexly fixes the jaws defying all attempts to open them, respiration ceases leading to profound cyanosis and the increased blood pressure dependent thereupon, which in turn may cause the rupture of sclerotic vessels. Atropine and morphine will decrease this tendency, but not eliminate it. The presence of the previously inserted mouth-gag saves the situation inasmuch as it is easy to open the jaws, pull the tongue forward, open the larynx and relieve the cyanosis.

If after ten minutes of administration of ether the patient shows no sign of relaxation I change off to chloroform through an Esmarch inhaler, unless contraindicated by the cardiac condition. By observing these precautions it is usually possible to handle these cases in the safest and most satisfactory manner.

As to the after-effects of ether anæsthesia: Nausea and vomiting are perhaps the most constant. This annoying, and at times dangerous complication, is greatly reduced by the gas-ether method. In a recent series of one hundred cases anæsthetized by this method by students under my instruction the following results were obtained: persistent vomiting (48 hours) in one case, a gall-bladder operation, the condition being ascribed to a low degree of acute gastric dilatation, 81 per cent. did not vomit at all after regaining consciousness, the remaining 19 per cent. had varying amounts of gastric distress during the first twelve hours, in a few

continuing during the first twenty-four hours. The use of oxygen and inhalation of vaporized vinegar have been given up after a thorough trial. If the patient be not over-anæsthetized oxygen is not needed, because there is no cyanosis, and the patient will regain consciousness within ten minutes after the last suture is placed, often moving and talking at random immediately after completion of the operation. The administration of oxygen did not seem to improve upon the statistics given above. A similar conclusion was reached after the use of vinegar.

Ether burns of the face never occur when the gauze drop method is adhered to. If the ether be spread over a sufficiently large evaporating surface and not allowed to drop in one place it will be found that the under surface of the gauze pad is entirely dry. In no case has an ether burn resulted in this series, nor in any of the cases anæsthetized by students.

The advantages of this method are: Its relative safety, comfort to the patient, the time and ether saved in anæsthetization, freedom from complications, such as bronchitis, pneumonia, annoying nausea and vomiting, shock and reduced vital resistance.

In conclusion I would make a plea for less profound anæsthesia in all cases, for rules preventing the junior resident from giving anæsthesia, unaided, and for the more extensive instruction of this art in our medical schools, in the light of its daily increasing importance.

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY.

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*Stated Meeting Held April 8, 1908.*

The President, DR. JOSEPH A. BLAKE, in the Chair.

### STRANGULATED FEMORAL HERNIA; RESECTION OF INTESTINE.

DR. IRVING S. HAYNES presented a woman of 40, who was admitted to the hospital on March 3, 1908. She had had eight full-term pregnancies and one miscarriage. About nine years ago she had had an attack of pain for a few hours in the lower part of the abdomen, more pronounced on the right side, and extending up toward the epigastrium. A second similar attack was felt some years later.

Her present attack, which began 25 hours prior to her admission to the hospital, came on suddenly with vomiting and pain in the right lower quadrant of the abdomen. The bowels were constipated. Her pulse on admission was 84; temperature, 99.4. Her condition was apparently so favorable that Dr. Haynes said he was not informed of her admission, and he did not see her until the following morning. Her pulse at that time was 72; temperature, 98.6. She complained of cramp-like pains in the epigastrium, and at long intervals raised some gas. She had on three or four occasions vomited a greenish fluid; her bowels had not moved.

Examination showed a small, hard, slightly sensitive femoral hernia, as large as an English walnut. An immediate operation was done, and through a two and a half inch incision a black loop of intestine was disclosed, three inches in length. There was no omentum in the sac. The constriction at Gimbernat's ligament was freely divided, and hot applications used for a quarter of an

hour. As the intestine remained black and lustreless, it was resected and an end-to-end anastomosis made with a double row of stitches. Three kangaroo tendon sutures were used to unite Poupart's ligament to the pectineal fascia and ligament. The bowels were opened on the second day by an ox-gall enema. The patient was out of bed on the twelfth day, and left the hospital on March 24.

#### PROLAPSE OF RECTUM; BLOODLESS RESECTION.

DR. IRVING S. HAYNES presented an Italian boy, ten years old, who was operated on March 19, 1908, for a prolapse of the rectum which had existed for seven years. At each defecation, about an inch of the rectum protruded. There was slight bleeding. The prolapse could be easily replaced and caused him no pain. The bowels were regular, and there was no history of constipation.

Upon examination, the sphincter was found relaxed, and the anus dilated and patulous. There was a superficial fissure in the anterior border of the anus; no ulceration of the mucous membrane. The rectum was cleansed and packed. The prolapsed section of the bowel was easily drawn outside of the anus for a distance of about three inches, and its base, half an inch from the anus, was ligated by overlapping but not interlocking ligatures passed by a round needle. For this purpose, No. 2 ten-day chromic gut was employed. The distal portion of the prolapse was excised to within a quarter of an inch of the ligature lines, and the cut edges whipped over with a button-hole stitch of Pagenstecher thread. On withdrawing the rectal tampon, the suture line immediately retracted above the anus.

A plug of gauze, three-quarters of an inch in diameter, with a quarter-inch rubber tube for a core, and covered externally by rubber tissue was fastened in place, and extended a short distance above the line of resection.

The boy made no complaint of pain or discomfort after the operation. His bowels moved spontaneously on the fourth day and expelled the plug, which was not replaced. At no time was there any bleeding. When he left the hospital, on March 27, there was a slight induration along the line of resection, but no contraction whatever. As to size, the rectum seemed perfectly normal.

PARTIAL GASTRECTOMY FOR UNUSUALLY SITUATED  
CANCER, WITHOUT OBSTRUCTION.

DR. GEORGE WOOLSEY presented a man, 66 years old, who was admitted to Bellevue Hospital on February 6, 1908. There was no history of pain after eating until two years ago when he began to complain of pain commencing about one hour after the ingestion of food. For the past year this pain had been constant, sharp and stabbing in character, and worse after eating. The appetite had not been lost. He had only vomited once or twice and there was no history of hæmatemesis. The patient had lost about 50 pounds in weight during the past two years.

Upon examination, the patient was found to be much emaciated, with a pale, yellowish complexion. His arteries were thickened; the pulse weak and intermittent. There was a systolic murmur near the episternal notch. The abdomen showed a smooth mass, about the size of an adult fist, to the right and a little above the umbilicus. It was slightly movable in all directions, and moved somewhat with respiration. It was tender on pressure, and tympanitic on percussion. An examination of the urine showed albumin, but was otherwise negative. The blood contained 45 per cent. of hæmoglobin, with 15,000 white cells.

Operation, February 13, 1908. A vertical incision was made over the mass, which was found to be adherent to the parietal peritoneum. Upon freeing these adhesions the mass slipped upward and toward the median line, and on extending the incision upward it was found to be a tumor of the pyloric end of the stomach and to be further adherent to the transverse colon. These were separated, and the mass was removed after closing the duodenum with three rows of sutures. A posterior gastro-enterostomy was then done with the Murphy button.

Five days after the operation bile and duodenal contents began to escape through the wound. In spite of that fact, the remaining fistula gradually closed spontaneously, and it was now absolutely closed. The Murphy button was passed on the twenty-first day. The tumor was pronounced by the pathologist to be a carcinoma of the pyloric end of the stomach which had formed on the base of an old ulcer.

He has gained much in weight, color and general condition. There were few or no lymph-nodes enlarged.

## URETERAL CALCULUS (TWO CASES); IMPROVED METHOD OF APPROACH.

DR. CHARLES L. GIBSON presented two cases to demonstrate an improved method of approach for calculi situated in the lower portion of the ureter.

The first patient was a man 62 years old whose symptoms dated back ten years. A calculus, weighing 270 grains, and located just at the brim of the pelvis was removed, and the ureter sutured in two layers. The wound was closed without drainage and healed by primary union within two weeks. Time of operation, 35 minutes.

The second patient was a man, 32 years old, whose symptoms dated back five years. A calculus, the size of a flageolet bean, was removed from the ureter. The ureter was sutured in two layers, and the wound closed without drainage. The patient was in bed ten days and left the hospital on the twelfth day after the operation.

The incision employed in both of these cases, Dr. Gibson said, was planned to give a maximum amount of room and exposure of the lesser pelvis, entirely extraperitoneal, and to damage as little as possible the muscular layers, and to be made in intersecting planes. The superficial portion of the incision was practically the same as that devised by Stimson and Pfannenstiel, *c.g.*, an incision was made through the skin, aponeurosis of the external oblique, partly through the aponeurosis of the internal oblique and partly across its muscular layer, beginning at the mid-line, a finger's breadth above the pubis, carried parallel to Poupart's ligament, and then vertically upward to or even beyond the anterior superior spine. The upper flap was then retracted well upward. The fascia of the transversalis was then divided just as it emerged from under the rectus, and parallel to it. With the patient in the Trendelenburg position the peritoneum was easily pushed upward, and the rectus muscle, which was much mobilized by the preceding incisions, was retracted well away. The room and view obtained by this method allowed of further extrapelvic manipulations being carried out with the greatest ease. In both cases the ureter was readily freed from its bed, and lifted on the finger to the level of the skin wound, permitting of its incision and careful suture with absolute precision.

DR. SAMUEL ALEXANDER said he had been present at both the operations reported by Dr. Gibson, and could testify to what had been said regarding the method of approaching the ureter that had been described. The incision gave one control of the ureter throughout its entire length, especially its lower portion. The operation was comparatively bloodless, and the only difficult feature of it was the securing of the ureter in place in order to open it. This was overcome by passing a retractor underneath the ureter, drawing it into view, and then it could be manipulated with great ease. The speaker said he considered the operation described by Dr. Gibson as a distinct and valuable advance in the field of ureteral surgery.

#### EXCISION OF KNEE.

DR. ROYAL WHITMAN presented a woman, 21 years old, who for a period of about six years had suffered from a rather severe form of tuberculosis of one knee-joint. She entered the Hospital for Ruptured and Crippled in December, 1907, where the knee was resected by Dr. Whitman. Three months after the operation the woman was able to resume her occupation as cook.

The removal of necrosed tissue from the tibia left two rather large excavations which had not in any way interfered with solid union.

#### OPERATIVE TREATMENT OF COXA VARA.

DR. ROYAL WHITMAN presented a boy, 10 years old, who was operated on in August, 1907, for coxa vara of five years' duration. To remedy the condition, Dr. Whitman did the following operation, which he had now employed in these cases for many years: A wedge of bone was removed from the base of the trochanter, with its apex directly facing the trochanter minor. The size of the wedge to be removed could be accurately determined by means of an X-ray picture. The bone was not absolutely divided as the cartilaginous trochanter minor remained, and there was therefore no danger of the fragments overlapping. The wedge was closed by gently abducting the limb, the neck being fixed by contact with the upper border of the acetabulum, and in this position of abduction a plaster spica bandage was applied which remained until union had taken place.

By this method, Dr. Whitman said, the full range of abduction was restored and functional cure was assured.

## FRACTURE OF THE NECK OF THE FEMUR.

DR. ROYAL WHITMAN presented a man, about 40 years of age, who four months ago fell, sustaining an injury to the right hip. He was taken to a hospital, and after remaining there for a few days, was sent home. He suffered a good deal of pain in the region of the injured hip, and after a few weeks applied for treatment at another hospital, where a spica bandage was applied with the limb in the line of the body.

Four months had now elapsed since the accident. Examination showed that although union of the fracture had apparently occurred, yet the limb was adducted and flexed. In this case, Dr. Whitman said, the deformity should have been reduced at once under an anæsthetic, the limb put up in full abduction and fixed by a plaster spica bandage. In that event a functional cure might have been anticipated in place of the disability illustrated by the patient which could be remedied only by operation.

## FRACTURE OF THE PELVIS; RUPTURE AND LACERATION OF THE URETHRA.

DR. SAMUEL ALEXANDER presented a man, 21 years old, who was admitted to Bellevue Hospital on March 4, 1908. On the evening of his admission a heavily laden wagon which he was driving was overturned and he fell under one of the wheels, which struck him upon the outer rim of the ilium and rested upon him, pinning him to the ground. He was not extricated until the wagon was lifted and he was then brought to the hospital by ambulance. He was at first admitted to the general surgical service, and examined by the house surgeon, who failed to recognize the nature of his injury. On the following morning it was found that he had retention of urine. An attempt was made to pass a catheter, and two or three ounces of blood was drawn, the catheter not entering the bladder. He was then transferred to Dr. Alexander's service.

Upon examination, the patient lay in the prone dorsal position, with the left hip flexed. Any attempt to move the hip caused great pain in the left groin. There was some ecchymosis over the crest of the ilium, and marked ecchymosis in the perineum, but no swelling.

By rectal examination a fracture of the left pelvic ramus was discovered. The fracture was oblique, and the outer frag-

ment was displaced downwards. The abdomen was tympanitic, but there was no tenderness, and no signs of extravasation of urine.

A silk coude catheter, No. 16 F, passed without much difficulty into the bladder; the urine drawn was perfectly clear.

*Operation.*—A perineal section was made, using the catheter as a guide. Upon introducing the finger, after opening the membranous urethra, the sharp end of the outer fragment of bone could be felt on the right side of the urethra. The latter had been cut through, and the wall, especially upon the left side, was lacerated. The upper end of the divided urethra had retracted for about  $\frac{1}{2}$  inch.

A metal perineal tube was put in place, the fracture was reduced, and the opening over the bone was plugged by a strip of iodoform gauze. The pelvis was strapped anteriorly with broad strips of adhesive plaster.

The patient was put in bed with shoulders slightly raised, and a circular rubber cushion under the buttock. Syphon drainage was established.

The tube and packing remained in place continuously and without interruption of the drainage for 8 days. The patient was kept in bed for four weeks. The perineal wound healed kindly, and with no complications. The bowels were moved by enema, and each movement was supervised to prevent soiling of the wound. At the end of four weeks dilatation of the urethra was begun by sounds. The patient was now well; the urethra admits No. 26 F without difficulty and urine was voided normally and in a good stream.

#### ENCYSTED HYDROCELE OF THE CORD (INGUINAL PORTION), RESEMBLING OMENTAL HERNIA.

DR. SAMUEL ALEXANDER presented a man, 20 years old, who was admitted to Bellevue Hospital on February 10, 1908, for a swelling in the right inguinal region. About one year ago the patient noticed a lump in the right groin which he says was about the size of an English walnut. He thought that at first this could be reduced by pressure, but for several months it has been impossible to reduce it, and he thinks that it is growing larger. Two weeks before admission he began to have sudden sharp shooting pains, especially at night after work. The swelling is painful when he coughs.

Upon examination, there is an oval tumor about the size of a small egg. This is adherent to the cord, and is situated within the inguinal canal. The swelling is tense and painless. Upon coughing there is slight impulse to the hand placed over the tumor, but no impulse to the finger passed through the external ring.

Diagnosis made of an encysted hydrocele of the cord. Operation, February 12, 1908. The inguinal canal opened as in Bassini's operation.

The tumor did not communicate with the abdominal cavity. There was no hernia. The tumor consisted of a sac lined with serous membrane, with a long diverticulum extending upward. The wall of the sac was thickened. It contained six drachms of clear hydrocele fluid.

The wound healed *per primam* and the patient was discharged March 3.

#### EPITHELIOMA OF PENIS; PARTIAL AMPUTATION OF PENIS AND LYMPH-NODES.

DR. SAMUEL ALEXANDER presented a man, 54 years of age, who was admitted to Bellevue Hospital December 5, 1907. He denied any venereal disease, but had been operated upon for an abscess in the groin twelve years ago. During November, 1906, he noticed a small nodule upon the glans penis, slightly ulcerated. He went to a dispensary, where a diagnosis of syphilitic chancre was made, and he was treated by injections of the salicylate of mercury. This treatment was continued for several months without causing any improvement. The growth has never been painful. There is no family history of cancer.

Upon examination, a nodule, slightly ulcerated and fungating at the edges was found upon the glans penis; the nodule was hard, and involved about one-half the entire thickness of the glans.

A section of this nodule was removed and examined by Dr. Ewing, of the Cornell University Medical College, who pronounced it an "epithelioma, the growth of which seemed to be slow." The inguinal lymph-nodes were enlarged and hard.

Operation, December 11. About one-half the penis was removed by a circular amputation, the urethra being cut  $\frac{3}{4}$  inch longer than the stump. The floor of this part of the urethra was split longitudinally, and the edges united to the skin and the sheath of the corpora cavernosa by sutures; the edges of the

skin were likewise sutured to the outer sheath of the corpora. The inguinal lymph-nodes were removed *en masse* from both sides. The patient was regularly catheterized for three days.

On January 21 the patient had a chill and rise in temperature to 104°, and developed erysipelas in the left inguinal wound, which had nearly healed. This delayed his convalescence and necessitated an incision of the left thigh. He did not leave the hospital until February 20.

A pathological examination of the inguinal glands showed no evidence of metastasis.

#### EPITHELIOMA OF PENIS; COMPLETE AMPUTATION OF EXTERNAL GENITALS AND INGUINAL LYMPH-NODES.

DR. SAMUEL ALEXANDER presented a man, 47 years old, who was admitted to Bellevue Hospital February 25, 1908. He denied all history of venereal disease. No family history of cancer. Six months before admission to the hospital he fell, striking the penis and scrotum upon a beam. No pain or swelling nor urinary disability followed. He had a congenital phimosis, and had never been able to retract the prepuce. Four months before admission he noticed a swelling in the right groin which was painful, but this partly subsided. Two months later the swelling recurred, and about the same time his penis began to swell and there was a discharge from within the cavity of the prepuce. He then began to have difficulty in urination, owing to obstruction at the meatus. The penis and the swelling in the inguinal region continued to enlarge, and the obstruction to urination became more marked. Upon examination, the penis was found greatly enlarged, measuring 3 inches in circumference; it was distorted, being curved upon itself to the right side. There was a profuse discharge of thin pus from the prepuce. The entire glans penis and the inner side of the prepuce were fungoid in appearance; the external meatus was reduced to the size of a fine needle.

The inguinal glands were enlarged upon both sides; the skin was reddened over these regions, and there was deep fluctuation upon the right side.

On February 27 a part of the prepuce and of the growth was removed for pathological examination, and was pronounced by Dr. Norris, pathologist to Bellevue Hospital, to be a very rapidly growing epithelioma.

On March 4, the inguinal nodes upon both sides were removed, and a complete amputation of the external genitals was performed, the urethra being transplanted to the perineum. The lymph-nodes were found diseased, and there were numerous metastatic deposits upon both sides. The wounds in the groin were left open; the remaining wound was sutured. The latter healed primarily, and the patient was discharged April 8. He passes a full stream of urine through the urethra, and has gained greatly in general health since the operation.

DR. CHARLES L. GIBSON said the question of the time of operation was very important in connection with cancer of the penis. The speaker said he could recall patients who were alive and free from signs of recurrence ten years after operation. He did not believe that removal of the inguinal glands added much to the security of these cases, because there was just as much chance that the deep-seated glands were involved. The secret of success in dealing with malignant disease in this location, as elsewhere, was to get hold of the cases early.

DR. ALEXANDER, in reply to a question, said the removal of the testes in these cases added much to the convenience of the patient. If they were permitted to remain, they interfered with urination. In some cases where he left the testes, he had split the scrotum in the median line, and then sewn up the incisions, thus making two complete sacs, which could be separated during the act of urination. It was usually preferable, however, to do a complete castration.

In early cases, where a partial amputation sufficed, it was not a good plan to take out the inguinal glands unless they were involved. He recalled one case where the operation was done nine years ago, without removing the inguinal glands, and the patient was still alive and well. In another case the recurrence was in the perineum, and not in the inguinal glands.

#### OPERATION FOR OLD INJURY OF THE FOREARM, INVOLVING THE FLEXOR TENDONS, MEDIAN AND ULNAR NERVES.

DR. WILLIAM A. DOWNES presented a man, 19 years old, who sustained an injury to the forearm 4 years ago, involving the flexor muscles and both nerves. As a result of this, the fingers of the right hand became absolutely fixed in a position of extreme flexion and the seat of trophic ulcers.

The patient was admitted to the General Memorial Hospital eighteen months ago, and the flexor muscles were exposed through an incision extending from the elbow to the wrist. This showed that these muscles in the middle third were represented by a cicatricial scar, no muscular tissue whatsoever remaining. The ulnar and median nerves were exposed, their upper and lower ends, which were separated in both cases over 2 inches, united by plastic operation, and the flexor tendons were lengthened by a tendon-splitting operation. The tendons were then wrapped in Cargyle membrane to prevent the formation of adhesions. There were evidences of some regeneration of the nerves since the operation and flexion had been gained to about one-half normal. The case was shown as evidence that much good could be accomplished in these cases of long standing contracture following trauma.

#### VOLKMANN'S ISCHÆMIC PARALYSIS.

DR. ALFRED S. TAYLOR read a paper with the above title, for which see page 394. In connection with his paper, Dr. Taylor showed a case illustrating the condition described.

DR. JOHN F. ERDMANN said that about two months ago he saw a case of this form of paralysis in a seventeen-year-old boy who came here from the South. He had sustained a fracture of both bones of the left forearm several months before, and this had resulted in ischæmic paralysis, with trophic changes in the area of the median nerve, with ulceration of the fingers at the terminal phalanges in the area supplied by the median, and profound trophic changes of the nails. He gave a history of tight bandaging with wooden splints for a period of seven days following the accident. Electrical examination made by Dr. Joseph Collins showed that the paralysis of the nerve was complete. An incision was made down the middle portion of the forearm, exposing a marked muscle and fascia infiltration. The median nerve was exposed, and about its middle portion in the forearm a constriction was found, due to the imbedding of the nerve in this infiltrate. This constriction was about two inches long, and the nerve was diminished fully one-half its size above and below the point of constriction. The interosseous nerve was also exposed and found to be compressed. In spite of the fact that a very light dressing was applied after the operation the tissues

rapidly became blue-black and cold. It was necessary to simply lay the forearm in a trough splint, without exercising any pressure whatever. Subsequent to the operation, the patient being under observation for three weeks only, a marked improvement was observed, the ulceration of the fingers and nails rapidly healed, and the color and vascular supply and the local temperature were very much improved. A certain degree of extension had been gained. A report by letter to-day shows that the patient has been considerably improved, but that union of his fracture had not yet taken place. No excision of bone, with a view of shortening the forearm and thereby lengthening the tendons, was done.

DR. JOSEPH A. BLAKE said he did not think this condition of ischæmic paralysis was so very uncommon. He could recall three such cases, one of them very recent. In one case, where he cut down upon the nerves, he found a condition of fatty degeneration of the muscles, which had not yet reached the fibrous stage. In the case he saw recently, the deformity and contraction were characteristic. Before considering shortening the bone in these cases, Dr. Blake said, he would suggest the use of massage, electricity and passive motion for a considerable period in order that the ultimate amount of contraction would be reached, thus obviating a relapse.

DR. TAYLOR, in closing, said that in recent cases, like the one mentioned by Dr. Blake, where no nerve changes had occurred, experience had shown that conservative treatment in the way of passive motion, massage and electricity accomplished practically nothing. In these cases, a Frenchman named Martin had recently suggested the use of a splint attached to the fingers by means of rubber bands, so that constant and moderate extension could be thus exerted. Two weeks ago, at a meeting of the Pediatric Section of the Academy of Medicine, Dr. Reginald H. Sayre showed a case of this kind in which he had used an orthopædic splint, by means of which the degree of extension could be regulated and gradually increased. In that case and also in Martin's the contracture appeared after seven weeks, so that both were probably comparatively mild cases with only partial cicatrization of the muscles. In both cases there was very marked improvement. This treatment gives no relief to damaged nerves.

*Stated Meeting, April 22, 1908*

The President, DR. JOSEPH A. BLAKE, in the Chair.

#### RESECTION OF TUBERCULOUS ELBOW.

DR. JOHN A. HARTWELL presented a bricklayer, 53 years old, who was admitted to Lincoln Hospital on March 9, 1905. In April, 1904, he first began to suffer from evidence of a tuberculous infection in the left elbow-joint. He paid no attention to this, and continued to work almost uninterruptedly for 11 months. He then applied for admission at the hospital. Examination showed a typical advanced condition of tuberculosis of all of the structures composing the elbow-joint. There were discharging sinuses leading into it which had opened spontaneously. The muscles of the forearm were infiltrated with tubercular material as far as the middle third. Operation was performed a few days later, a typical resection of the joint being done through an externodorsal incision. All the joint structures were removed, the humerus being sawed through at the epicondylar level, the ulna just below the coronoid, and the radius through its neck. This was done subperiosteally in each case, the expansion of the triceps and the insertion of the biceps being carefully preserved, as well as the origin of the muscles arising from the condyles. The tubercular sinuses in the forearm were thoroughly opened and scraped. A dressing of iodoform paraffin plug was used, and the arm put up in the extended position. Convalescence was very slow, numerous tubercular abscesses having to be opened. The joint was moved from one position to another, so as to allow the best possible drainage, at the same time endeavoring to keep the bones in close apposition. Complete healing of the sinuses did not take place for more than a year. During the past two years the patient has had increased power and usefulness in the limb, and he has gained about 30 pounds in weight. Examination and X-ray (Fig. 1) at the present time show that there is no apparent true joint formation, the condition being a mild degree of flail-joint. He has, however, considerable power, both in flexion and extension; he has absolutely no pain in the joint, and is able to use it for light work. A flexion splint has been worn part of the time to prevent lateral movements, but he seems to have more comfort without it. The case is shown as one of a very

FIG. 1.



Condition of elbow joint four years after resection for tuberculous.



fair functional result, in spite of the loss of a considerable amount of the bony structures, and the very advanced involvement of the soft tissues at the time of operation. The functional value of the muscles arising above the external condyle is well preserved, and these serve a much useful purpose in the movements he enjoys. His general health at the time of operating and the local disease were of such a nature that amputation was seriously considered, and the convalescence was so slow that subsequently it presented itself as the only means of cure.

DR. WILLY MEYER said that the Kocher incision gave very free access to the elbow joint, and the final functional result of this method of resection, on account of the preservation of the triceps tendon and part of the olecranon, was usually excellent. Dr. Meyer said he was strongly in favor of doing these operations without the use of the Esmarch bandage, and he recalled two instances where paralysis lasting several months and seriously interfering with the after-treatment followed the application of the bandage. In tuberculous cases where sinuses persisted, he thought the hyperæmic treatment would prove very serviceable.

#### OLD FRACTURE OF PATELLA: LENGTHENING OF QUADRICEPS.

DR. HARTWELL presented a negro, 42 years old, a truckman, who was admitted to the Lincoln Hospital on February 5, 1908. The history he gave was that about two months previously he had fallen from a truck, striking against the street curbing, and receiving, probably by direct violence, a fracture of the left patella. Excepting for a bandage about the knee, he received no treatment whatever. He remained in bed for a time, and then resumed his work as a truckman. He was able to walk on a level surface with very little trouble, but was unable to go up stairs or extend his knee when any weight was upon it. He is unable to raise his heel from the bed when lying in a dorsal position.

There is a transverse fracture of the patella, with a separation of  $3\frac{1}{2}$  inches between the fragments, which can be reduced to about 3 inches by firm traction. There is considerable outgrowth about the fragments, so that each fragment measures approximately 2 inches in its vertical diameter, the right patella having a vertical diameter of 3 inches.

Operation was performed on February 8, 1908, as follows:

The patient was placed in a dorsal position, and a vertical incision about 6 inches long was made over the fragments, exposing the muscle and tendon above. The fibrous union between the fragments, which was very much stretched and thin, was cut away, and the joint exposed and irrigated. The aponeurosis on each side was stretched, but as it contained very heavy fibrous bands, it was cut, and about 1 inch resected on each side of the patella. The fragments were now  $3\frac{1}{2}$  inches apart, but could be forcibly reduced to  $1\frac{1}{4}$  inch. A thin layer was sawed from the fractured borders of the patella to procure fresh surfaces for apposition. An M-shaped incision was then made into the quadriceps tendon and muscles, the outer legs beginning on the two borders of the tendon and running upward and inward toward the midline; the inner legs running from these and converging to a point directly above the patella, and about 1 inch from it (length of each leg about 3 inches), and carried to a depth of about two-thirds of the thickness of the muscle and tendon. Traction now brought the fractured edges of the patella into good apposition, with a comparatively small amount of tension. Two holes were now drilled into each fragment, and a square suture of very heavy silver wire put in and twisted on the anterior surface of the upper fragment. The aponeurosis just outside of the patella was overlapped and sutured with three stitches of heavy kangaroo tendon, thus bringing the fragments in perfect apposition. The remaining parts of the aponeurosis were overlapped and sutured with chromic gut No. 2, doubled. The apices of the incision in the tendon were united with the apices of the muscle, thus lengthening the vasti about 2 inches, and the parts sewed together with chromic gut No. 2, doubled. A counter opening was then made well back on the outer surface of the knee-joint, through which a large cigarette drain was passed. The skin was sutured with silk, and a sterile dressing applied, with a circular plaster splint encasing the whole of the lower extremity, with a window cut exposing the original incision and drainage wound. A small rubber tissue drain was placed in the lower angle of the skin incision. The patient was returned to the ward in good condition.

The wound healed *per primam* excepting at the exit of the drain, which healed in the course of ten days by granulation. There was no rise of temperature at any time. On the second day the patient got out of bed and walked to the bathroom,

FIG. 2



Old widely separated fracture of the patella after tendon-lengthening and wire suture.



without apparent harm. With this exception he was kept in bed for five weeks. The first dressing was done on the fifth day, and the drains removed. On the tenth day slight passive movements of the patella were begun, the two fragments being firmly grasped and moved together. This was repeated each day for about three weeks, the amount of motion being increased gradually. After about five weeks the patient was encouraged to lightly contract the quadriceps muscle, so as to exert traction on the patella, the extremity still being encased in plaster. The splint was left off at night in the sixth week, and passive and active motion gradually begun. At the end of seven weeks the patient began to walk without a splint, but was cautioned against throwing any weight on the knee in a flexed position. At the present time (ten weeks after operation), he has a range of motion of about 45 degrees, both passively and actively. He walks without a limp, but complains of pain on long standing. This is probably due to the pressure of the wire suture against the condyles, and it may be that a subsequent operation may be necessary for the removal of the wire. Palpation of the patella shows strong fibrous union between the fragments, with no apparent separation on flexion of the joint. The X-ray plates, however (Fig. 2), show that there is a tendency to such separation, and that the wire suture is probably still bearing a considerable strain, though there is no evidence that it has cut through the patella to any extent. The quadriceps tendon and muscles, apparently, are functioning normally.

#### BILATERAL NEPHROTOMY FOR NEPHROLITHIASIS.

DR. JOHN A. HARTWELL presented a man, 46 years old, a clerk, who was admitted to Lincoln Hospital on January 30, 1907. He had an attack of gonorrhœa 20 years ago, without sequelæ. Otherwise, aside from his present history, he had always enjoyed good health. In 1905 he had an attack which suggested a left renal calculus. After that he was operated on at a hospital in another city a left nephropexy being done, apparently under the belief that his trouble was a movable kidney, with a Dietl's crisis. He had no further attack on the left side. About ten days prior to admission to Lincoln Hospital he received a blow from a blunt object over the right abdomen in the lower lateral quadrant. The blow was severe enough to knock him down, but did not

prevent his continuing at work. The day following, however, he had considerable pain in the region of the kidney, and tenderness over the right side of the abdomen, with distention and rigidity. This continued rather severely until his admission to the hospital. Inspiration was especially painful. He was running a temperature from 100 to 103, with accelerated pulse. The leucocyte count showed 20,000. Examination showed the whole abdomen rigid, more marked over the appendix and right hypochondriac, where pressure was very painful. The condition was diagnosed as a possible appendicitis, but more probably as a perinephritic inflammation. There were a few râles over the lower right chest, suggesting also a pleurisy. He was kept under observation for about three weeks. During the first week the symptoms continued unchanged, and he had several chills. Then they all subsided, and he was discharged from the hospital. He continued, however, to have more or less constant pain in the region of the right kidney and was re-admitted to the hospital on March 13th. Examination at this time showed the same condition as before, but to a much less degree, and he did not have any fever. A cystoscopic examination showed no abnormalities in the ureteral orifices. The ureters were not catheterized because this procedure was, for some reason, exceedingly painful, and offered special difficulties. X-ray plates at that time showed no abnormality in the right urinary tract, but gave a shadow in the line of the left ureter. As he had had no symptoms referable to this side other than the attack three years ago, and as all his present symptoms were referable to the right kidney region, and in view of the recent injury, it was decided to explore that organ. Accordingly, operation was performed on March 20th, a right nephrotomy being done through a vertical incision. The tissues overlying the kidney were found slightly contused, particularly about the fatty capsule. The kidney was slightly more adherent than normal, and the capsule seemed somewhat thickened. A longitudinal incision was made through the kidney substance into the pelvis of the kidney just posterior to the convex border. Evidence of an old pyelitis was found in the shape of some necrotic tissue at the apices of two or three of the pyramids. It was cut away, and was reported by Dr. Ewing to be necrotic tissue. A small drain was put down into the kidney, and the wound sutured in layers. Healing by primary union took place.

There was no urinary nor purulent discharge from the sinus. About six weeks later, however, he passed two stones *per urethra*, with no antecedent symptoms in the ureteral tracts. With this exception, the subsequent history was uneventful, and he remained well until the following December. He then began to have pain over the left kidney, with tenderness and some fever. He was ill for a few days and then recovered, but still had some pain in the left kidney region. He was re-admitted to Lincoln Hospital on March 3, 1908, having been more or less invalided most of the time since the previous December. Examination indicated a low grade of sepsis, with dry skin and tongue, and considerable emaciation. Temperature, 98; pulse, 120; respiration, 28. Blood examination, 12,000 white cells; 81 per cent. polynuclears. Urinary examination showed a few red blood and pus cells; otherwise normal in quantity and composition. Aside from pain along the kidney and left ureter, there were no subjective symptoms. Neither kidney could be palpated, but considerable tenderness and rigidity was present over the site of the left side. No cystoscopic examination was made. Operation, March 11th: The patient was placed in the right lateral prone position and a vertical incision was made in the left lumbar region, exposing the fatty capsule. The kidney was very adherent by its convex surface to the lumbar wall as the result of the former nephroscopy. The adhesions were broken away with the fingers, and the kidney delivered through the wound. It was found divided into two parts, the upper quarter of the kidney being almost entirely separated by a deep depression running around the organ. The pedicle of the kidney was grasped in the fingers, and a vertical incision made through the convex border. The upper pole of the kidney was found to be a mere shell, with a necrotic lining showing a calyx connected with the ureter. Two or three spots of necrosis in the kidney substance were removed. A catheter was passed through the ureter into the bladder without meeting with any obstruction. The necrotic shell of the upper pole was cut away, and the kidney sutured and returned to its bed. A rubber tissue drain was put through the kidney substance into the pelvis of the organ. The muscles and skin were then sutured, and two cigarette drains inserted down to the kidney. A dry sterile dressing was applied, and the patient returned to the ward in good condition and a few grave negative

bacilli cultures from the kidney pelvis showed a growth of staphylococci-streptococci. There was some urinary leakage along the track of the drain for the first five days; this then subsided, and the drains were entirely removed. The sinus was practically closed by the tenth day. He continued, however, to have some pain along the site of the left ureter. On the twelfth day this pain was severe, and there was an elevation of temperature (the only fever that he had), following which the sinus opened and discharged a little purulent urine. Two days later he passed a small rough calculus *per urethram*. Convalescence was uninterrupted from this time on, and he left the hospital at the end of four weeks free from symptoms, and with the wound entirely healed.

The case is shown as illustrating the difficulty of locating small stones in the urinary tract and because of the interest attaching to the rather varied symptoms which may result therefrom.

Dr. Hartwell said that he was indebted to Dr. Osgood for taking the radiographs and making the cystoscopic examinations in these cases.

#### PERFORATING GASTRIC ULCER.

DR. CHARLES L. GIBSON presented a man, 27 years old, who had always enjoyed good health and had suffered from no digestive disturbances until the 19th of November, 1907, when he first complained of a vague discomfort in the stomach. In the middle of the afternoon he suddenly experienced an agonizing pain in the epigastrium. He also complained of severe pain in the left supraclavicular fossa, but this was temporary. The abdomen was of board-like rigidity.

The case was regarded as one of perforating gastric ulcer, and the patient was transferred to the hospital immediately and operated on within three hours after the onset of the pain. A perforation of the stomach wall was found near its pyloric end. This was closed by a double purse-string suture, and pelvic drainage maintained for 48 hours. The man made an uneventful recovery.

Dr. Gibson also presented a second patient, a truck driver, 23 years old, whose history was not unlike that of the preceding case. After moderate epigastric distress he had a violent, sudden attack of pain in the region of the stomach. He was taken to the

hospital and operated on five hours after the onset of his acute pain. He gave no previous history of gastric disturbance, and had never vomited in his life.

A fairly large perforation was found on the anterior wall of the stomach, close to the pyloric end. It was easily closed with a purse-string suture, with temporary drainage of the pelvis.

In neither of these cases, Dr. Gibson said, did he resort to a gastro-enterostomy with a permanent cure in view. He doubted whether it was desirable to complicate acute cases of this kind by such a procedure. Many of these patients after proper treatment, showed a condition of the gastric contents which was practically normal, and he did not know whether a gastro-enterostomy would eventually become necessary or not.

#### PERFORATING DUODENAL ULCER.

DR. WILLIAM A. DOWNES presented a boy, 18 years old, who about a year ago had a sudden, sharp attack of pain in the epigastrium, lasting half an hour. He did not vomit, and although he felt weak, he was able to continue with his work. Since that time he has had periods of discomfort in the epigastric region, which he attributed to indigestion. He had occasional attacks of vomiting during the past six months, but had never vomited blood nor had his stools contained evidences of blood so far as he knew.

About noon, on Saturday, March 21, 1908, while working on a scaffold with both arms extended over his head, he was seized with a violent attack of cramp-like pain in the region of the umbilicus. He did not vomit, but felt weak, and his body was covered with perspiration. After lying down for half an hour, the pain passed off, and he was able to ride home, a distance of about a mile, on a car. His supper consisted of egg, bread and butter, and the following morning he felt as well as usual with the exception of some tenderness in the right side of the abdomen. Sunday evening he consulted his physician, who made a diagnosis of appendicitis and advised operation. On Tuesday, March 24th, three days after his attack of pain, he walked to the hospital, a distance of half a mile. His temperature on admission was 99.5; pulse, 80. There was moderate rigidity of the right rectus, and indefinite tenderness in the same region. No jaundice. The bowels were open. A diagnosis of subacute appendicitis was

made, an operation advised and set for the following day. An examination of the urine made on Wednesday morning showed a trace of bile. Otherwise negative. At 1.30 that afternoon, half an hour before the time set for the operation, while lying quietly in bed, he was seized with an attack of pain similar to the one he had had on the preceding Saturday. When Dr. Downes first saw him, half an hour later, the pain had lessened somewhat, but he was lying with his knees drawn up, the body covered with cold perspiration, and complaining of intense pain in the entire right side. There was board-like rigidity of the abdomen. The diagnosis of appendicitis was then doubted. The abdomen was examined under ether with negative results.

Operation: An intermuscular incision was made over the appendix, and upon opening the peritoneum a slight amount of bile-tinged serum escaped. The appendix was readily drawn up, and its peritoneal coat was found congested. The appendix was removed and opened, but there was no evidence of disease in the mucous membrane. The abdominal wound was thereupon closed and a second incision was made over the gall-bladder. Upon opening the peritoneum at this site, there was a gush of bile-colored serum. The gall-bladder, which presented in the wound, was moderately distended but apparently normal in appearance, with the exception of slight congestion of its peritoneal coat. It contained no calculi. Thinking that possibly the trouble lay in the ducts, the finger was passed along the cystic duct into the foramen of Winslow, and an indurated mass was immediately felt between the finger and the abdominal wall. This was drawn into the wound, and proved to be the duodenum. It presented an open ulcer, three-eighths of an inch in diameter, situated on its anterior surface, about an inch and three-quarters from the pylorus. There was a free escape of bile and mucus, but no particles of food. There were no fibrinous adhesions at any point. The edges of the ulcer were smooth, and there was no bleeding. There was moderate induration and œdema extending from three-quarters to one inch on all sides.

The perforation was closed by two purse-string sutures of silk. The lumen of the gut did not seem to be diminished sufficiently to warrant doing a gastro-enterorrhaphy. The bile-stained mucus was sponged away, but the abdomen was not washed out. A cigarette drain was inserted which was removed on the second

day. Food was taken by the mouth on the third day. Convalescence was uneventful.

DR. HOWARD LILIENTHAL called attention to an article by Dr. E. A. Codman which appeared in the *Boston Medical and Surgical Journal* (April 16th). In this paper the author suggested that many of these ulcerations of the duodenum and also of the stomach might be due to the chemical changes caused by compression of the duodenum by the mesentery, and he explained the beneficial results of gastro-enterostomy on the ground that it relieved the distention caused by this constriction. As a possible remedy for this condition, Dr. Lilienthal suggested transplanting a part of the constricted duodenum to the right, so that it would turn before the fold of the mesentery crossed it. Unless the anatomical causes of stagnation in the duodenum and gastric hyperacidity could be relieved, the end-results of operation for gastric ulcer were not very promising, and the speaker said he knew of one case where three such operations were necessary for recurrent ulcer.

DR. WILLY MEYER said that during the past winter he had operated on a man, 56 years old, with a gastric perforation near the pylorus. In this, as well as in a second case he had in mind, the stomach wall was so much infiltrated that a double row of Lembert sutures was necessary, the usual purse-string suture being out of the question. The case seen last winter was operated on 22 hours after perforation, and promptly recovered and left the hospital at the end of the third week. About one month later he developed ileus due to adhesions, and subsequently his symptoms pointed to a second perforation at the original site. The abdomen was again opened, and an abscess drained. The point of leakage could not be found, and the patient died. In that case, Dr. Meyer said, he felt confident that if at the time of the original operation he had done a rapid gastro-enterostomy, the future course of events might have been avoided.

In a second case which he operated on a few days ago the symptoms were apparently so mild that the patient was able to walk into the hospital. The stomach wall was so much infiltrated that Lembert sutures were necessary. In that case he did an immediate gastro-enterostomy.

DR. ELLSWORTH ELIOT, JR., said he had operated on quite

a number of cases of duodenal ulcer with very satisfactory results, and yet no gastro-enterostomy was done. On the other hand, he was inclined to agree with Dr. Meyer that in some of these cases, a secondary gastro-enterostomy might prove necessary, but as to the advisability of doing it at the time of the primary operation, that was an open question.

Dr. Eliot said that a review of his old cases of gastric and duodenal ulcer showed that in a great majority of the cases the perforation occurred without premonitory symptoms.

DR. CHARLES H. PECK said he agreed essentially with Dr. Eliot's views. He had had eight cases of perforating gastric and duodenal ulcer, and in none of them had he done a gastro-enterostomy at the time of the primary operation. Six of his cases recovered, and of the five of these that he had been able to follow none had shown any symptoms that demanded a secondary gastro-enterostomy. In several of these cases, the perforation was near the pylorus, and in more than one he feared that sufficient narrowing of the pylorus would occur to require a gastro-enterostomy. Personally, Dr. Peck said, he believed that the gastro-enterostomy should not be done as a routine measure at the time of the primary operation, but only as a secondary operation if the symptoms warranted it.

DR. JOSEPH A. BLAKE said the question of whether a gastro-enterostomy should or should not be done depended entirely on the degree of obstruction to the pylorus. Of course, in deciding whether a gastro-enterostomy should be done at once or subsequently, one had to be guided largely by the condition of the patient at the time. Many of these patients are in very good condition. In a case which he operated on recently there was complete stenosis of the pylorus after closure of the ulcer, and a gastro-enterostomy was immediately done. Gastro-enterostomy should not be a routine procedure in these cases, the indications for it being the same as in ulcer of the stomach without perforation. Dr. Blake said he did not think it was necessary to resort to drainage in these cases; they got along perfectly well without it.

#### CARCINOMA OF THE MALE BREAST.

CHARLES L. GIBSON presented a man, 62 years old, whose past history was unimportant. Until about four months before coming under observation, when he first noticed a lump in the

right breast, which grew slowly. When Dr. Gibson first saw the patient, the growth had attained the size of an adult palm, and was adherent to the chest wall. A pathological examination showed it to be a typical carcinoma, having apparently begun in the gland tissue. There were no enlarged glands in the axilla. The mass was excised and the defect remaining was closed with skin grafts.

Dr. Gibson said frequency of carcinoma of the breast in men, is estimated within widely varying limits, some observers placing it as high as one in men to twenty in women, others as one in a hundred.

Dr. H. LILIENTHAL said that in two cases of carcinoma of the male breast coming under his observation, one was attributed by the patient to the more or less constant irritation of the nipple caused by his suspender buckle.

Dr. WILLIAM B. COLEY said he had seen two cases of carcinoma of the male breast. One began as a case of Paget's disease of the nipple, while in the other the tumor was within the breast.

Dr. JOHN F. ERDMANN said he had seen four cases of carcinoma of the male breast, one recently, and three that were already on record. Two began about the nipple: in the other two he could not say where they originated.

INOPERABLE ROUND-CELLED SARCOMA OF THE BACK,  
WITH METASTATIC TUMORS INVOLVING A LARGE  
PORTION OF THE LOWER JAW—ENTIRE DIS-  
APPEARANCE UNDER TWO AND A HALF  
MONTHS' TREATMENT WITH THE  
MIXED TOXINS.

Dr. WILLIAM B. COLEY presented a man, 27 years of age, who had always been in good health previously; good family history; no history of injury, first noticed a tumor in the lower lumbar region in September, 1907. This grew with great rapidity and had reached the size of two fists in the latter part of September, when it was operated upon at the City Hospital by Dr. J. C. Biddle. A portion of the tumor was sent to the Jefferson Medical College Hospital, and the examination was made by Dr. John Funke, the pathologist to the hospital, who pronounced it large round-celled sarcoma. The tumor was apparently of fascial or muscular origin; it did not involve the bone, but extended down to and around the spinal nerves. It recurred immediately and

reached its original size, when a second operation was performed in the latter part of October by Dr. Biddle. At about this time a metastatic tumor developed in the lower jaw. The patient was sent by Dr. C. B. Dreher, of Tamaqua, Pa., for advice on November 16, 1907. Examination at this time showed a large, unhealed wound in the lumbar and sacral region, 6x8 in. in extent, the unhealed portion being the shape of an excavation nearly an inch deeper than the surrounding surface. The bottom of the wound showed evidence of recurrence. The lower jaw showed a metastatic tumor beginning one inch to the left of the symphysis on the right side and extending to the angle of the jaw on the left, occupying the entire thickness of the jaw. The patient had lost more than 40 pounds in weight; he was cachectic in appearance, and unable to walk without help. Although the chances of success from the toxins were exceedingly slight, they were sufficient to make it wise to give the method a trial. One quarter minim injected into the gluteal region was the initial dose; the latter was gradually increased until a temperature reaction of 102-103° was produced. Under these systemic injections, the tumor of the jaw began to diminish in size and became very much softer. When it had become almost fluctuating, an incision was made over the most protuberant part, and it was found so highly vascular that it was difficult to control the bleeding. The patient's general condition began to improve after the first 2-3 weeks' treatment. The tumor in the jaw became gradually less and less vascular, and after six weeks' treatment a portion of it was curetted out through the exploratory incision, and examined microscopically. It was found to be a round-celled sarcoma, of the same type as the primary disease. By this time the improvement in his general condition became much more rapid, and he gained 16 pounds in a single month. The wound healed rapidly, and all evidence of tumor growth, both in the back and jaw, had disappeared at the end of 2½ months' treatment, with 47 injections. The patient left the hospital on February 8, 1908, and the treatment was continued once a week by his family physician, after his return home, only small doses being given, not sufficient to produce any marked reaction. The largest dose in this case was 8 minims. All the injections, with the exception of five of the filtered toxins made into the jaw, were systemic, being given in the gluteal region and thigh. At the present time, about six

months after the beginning of the treatment, or three months after the tumors disappeared, the patient is in perfect health. He has resumed his work, and has gained 49 pounds in weight. There is not the slightest evidence of a tumor remaining, either in the jaw or in the back.

#### SUPPURATIVE ARTHRITIS OF THE KNEE.

DR. GEORGE PECK, in the absence of Dr. George E. Brewer, presented a negro boy, who was admitted to the service of Dr. Brewer at Roosevelt Hospital for a penetrating gun-shot wound of the left knee-joint. The case was first treated by exploration and drainage, but it was subsequently found that the bullet had injured the internal condyle of the femur, and septic symptoms developed. Five days after the injury Dr. Brewer exposed the knee-joint, and put the leg up in a flexed position; in this posture it was drained for six weeks; then a typical resection was performed, and the leg replaced in complete extension, the method followed being that of Mayo. The operation was done on the 10th of last March. The patient made a good recovery; he still wore a splint.

#### UNDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA.

DR. JOHN B. WALKER presented a boy of 19 years, who came under treatment for an undescended right testis associated with an inguinal hernia on the same side. Upon operation the testis was found lying above the internal ring in peritoneal cavity. It was brought down into the scrotum, where it has since remained. It is unusual to find the testis in the abdominal cavity and requires more than usual dexterity to free it so that it remains in the scrotum.

#### REPOSITION OF ABDOMINAL UNDESCENDED TESTIS IN SCROTUM, FOLLOWED BY NECROSIS.

DR. CLARENCE A. McWILLIAMS presented a man, 22 years old, who since his third year had had a left inguinal hernia, and absence of the testis on that side. He applied for operation for his hernia, and upon opening the inguinal canal the missing testis was found just inside the internal ring. It was about half the size of a normal testis. The vas descended beside the testis to

the external ring, and then curved upwards again to the testis. On attempting to bring the testis down it was necessary to divide the pampiniform plexus, and in doing this the artery of the vas was accidentally cut. Following this there was no difficulty in getting the testis into the scrotum, and then the hernial operation was completed.

About a week after the operation there was fluctuation in the scrotum, and an incision showed that the testis had necrosed in its new position. The hernial wound remained perfectly clean. The necrosis of the testis, Dr. McWilliams said, would probably not have occurred if the artery of the vas had not been divided.

#### THE TREATMENT OF UNDESCENDED OR MALDESCENDED TESTIS, ASSOCIATED WITH INGUINAL HERNIA.

DR. WILLIAM B. COLEY read a paper with the above title for which see page 321.

Dr. Coley also showed a number of patients illustrating his subject. The histories of these cases were contained in his paper.

DR. CHARLES N. DOWD, referring to the technic of the operation, said that nine years ago, at a meeting of this Society (*ANNALS OF SURGERY*, '99, vol. xxx, p. 338), he showed two cases where he had sutured the cord at the external ring, passing small chromic gut sutures through the fibrous tissue of the cord and through the external oblique aponeurosis. Since then he had followed the same procedure in many cases and he was convinced that it was of distinct advantage. It is difficult to speak positively in regard to the advantages of any particular technic, because the cases themselves differ so widely. The speaker said that in a recent case of double undescended testes with conditions the same on both sides he had on one side stitched the cord to the margin of the external ring and also stitched the tunica albuginea to the scrotum, while on the other side he omitted to do this. The result was much better on the side in which the stitches had been taken.

DR. JOHN B. WALKER said that in most of the cases he had seen, the difficulty in bringing down the testis was due to the shortness of the sac. On opening the sac in the inguinal canal, he was able to bring the cord down to the external ring, where it turned back on itself. On attempting to bring down the testis, very little progress was made, but on dividing the sac, the testis

was immediately released. The speaker said he never had a case in which he was unable to bring the testis down by this method, and he had never seen atrophy result.

DR. BLAKE said that if the operator took advantage of the Fowler method of dividing the deep transversalis fascia from the external ring to the spine of the pubes, an inch or more could be gained in the transplantation of the cord. It afforded a more direct route in bringing the cord down to the scrotum. Another point in the technic was to make use of the external oblique and the intercolumnar fascia to crowd down the testis.

DR. ERDMANN, commenting on the statement contained in Dr. Coley's paper that strangulated inguinal hernia of the superficial variety associated with undescended testis was rare, said he had operated upon four or five such cases.

DR. COLEY, replying to Dr. Erdmann, said he had seen but a single case of strangulated omental hernia associated with undescended testis, and they had never seen a case of strangulated hernia at the Hospital for Ruptured and Crippled, associated with undescended testis.

The point of suturing the cord at the external ring, which Dr. Dowd had suggested a number of years ago, had more recently been claimed by a French writer, who had resorted to it in 15 cases with very satisfactory results. Dr. Coley said that personally he had never tried it, but he thought the idea was a very good one. The same was true of the point in technic suggested by Dr. Blake to assist in bringing down the cord.

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, Held Monday, April 6, 1908.*

### INFANTILE PARALYSIS TREATED BY TENDON TRANSPLANTATION AND NERVE ANASTOMOSIS.

DR. ASTLEY P. C. ASHHURST presented several patients from the Orthopædic Hospital, from the services of Dr. G. G. Davis and Dr. R. H. Harte, to whom he was indebted for permission to operate and to report the operations.

*CASE I.—Paralytic Varus; Transplantation of Tibialis Anticus into the base of the fifth metatarsal bone.*

Alfred C. came to Dr. Harte's clinic, April 20, 1905, when 11 years of age. In December, 1901, when 7 years old, he had had a disease in which both legs and arms were paralyzed, and which confined him to bed for five months. The boy was unable to walk alone for a year afterwards. His family physician has informed Dr. Ashhurst that the diagnosis of cerebrospinal meningitis was confirmed by the board of health. When seen at the Orthopædic Hospital the chief complaint was that the left ankle turned very easily, and that the boy was constantly falling; there was quite a noticeable limp. The peroneal muscles were paralyzed, and there was a mild degree of varus, the foot turning easily until the sole was parallel with inner surface of the tibia. He had been wearing a brace for several years. A new brace was ordered which held the foot in perfect position. The patient wore this brace for nearly two years longer; and it was then decided, as no further improvement had occurred, to resort to operation. As a preliminary the foot was stretched manually, and put up in plaster in an over corrected (valgus) position, on February 18, 1907. On April 4, 1907, Dr. Ashhurst transplanted the tendon of the tibialis anticus to the base of the fifth metatarsal bone. The cast was changed at the end of three weeks,

and a new one applied for five weeks longer. At this time, eight weeks after the operation, the transplanted tendon was firmly attached at its new insertion, and by its contraction flexed the foot into a very slight valgus position. A shoe was ordered, with its sole raised on the outer side, so as to maintain over-correction for some time longer. Two months later it was noted that all the motions of the foot were normal, the transplanted tibialis anticus everting and flexing the foot well, while the power of inversion was retained by the tibialis posticus. The boy now walks without any limp, never falls from turning of the ankle, and except for the scars of operation, it is difficult to tell which was the paralyzed foot.

CASE 2.—*Paralytic Valgus, ankle-drop, and knee-drop. Transplantation of peroneus brevis to the base of the first metatarsal bone; and transplantation of the gracilis and semi-tendinosus to the upper border of the patella.*

Frank W., entered the service of Dr. G. G. Davis, February 26, 1907, when 11½ years of age. He had had infantile palsy at the age of 10 months, and had been under the care of Dr. T. G. Morton, who ordered a brace and had the patient treated with electricity. Later at the University Hospital, an operation (arthrodesis?) was done on the ankle, and a brace was ordered. When the patient came to the Orthopædic Hospital he could hardly walk at all without his brace, having to put his hand on his left knee at every step to keep it from collapsing like the blade of a pocket knife into the handle, as there was absolutely no power of holding the knee extended. Besides the paralysis of the quadriceps extensor femoris, the following muscles of the foot were paralyzed: tibialis anticus, extensor longus hallucis, extensor longus digitorum, tibialis posticus, and flexor longus hallucis; the calf muscles were weak, but contracted feebly. The only muscles which contracted well were the peronei, and the flexor longus digitorum. On April 17, 1907, Dr. Ashhurst transplanted the peroneus brevis to the base of the first metatarsal bone, to replace as far as possible the paralyzed tibialis anticus; at the same time the gracilis and the semitendinosus were transplanted into the upper margin of the patella. The plaster cast was removed eight weeks later, and, after the patient's old brace had been fitted, another cast was applied while alterations were being made in the brace. It was found possible to dispense with

the apparatus above the knee, as the transplanted hamstring muscles effectually prevented the collapse of the knee in walking, although voluntary extension is not yet possible. He never falls down now, and the transplanted peroneus muscle can slightly invert the foot and correct the extreme valgus deformity present before the operation. The boy, however, still wears the old brace to keep his foot in good position, and it seems probable that arthrodesis will have to be resorted to before the brace can be entirely discarded. There is also paralysis of the erector spinæ group of muscles, and the limp, due partly to the shortening of the whole lower extremity, is aggravated by the extreme lordosis.\*

CASE 3.—*Paralytic calcaneus, with varus and foot-drop. Transplantation of the anterior tibial nerve into the musculocutaneous; and of the peroneus longus muscle into the insertion of the tendo Achillis.*

Fred J. S., entered Dr. Davis's service February 26, 1907, when 7 years of age. He had had infantile palsy at the age of 2 years, affecting both legs. The left leg largely recovered its functions, only a slight cavus deformity remaining. The right foot showed moderate calcaneus, with varus and foot-drop. The peroneal muscles contracted well, but there was paralysis of the following muscles: tibialis anticus, extensor longus hallucis, extensor longus digitorum, flexor longus digitorum, flexor longus hallucis, and the muscles of the calf. The condition of the tibialis posticus was doubtful, but it was certainly very weak. The only voluntary motion possible was a very feeble extension (plantar flexion) and abduction of the foot by contraction of the peroneal group. There was no power of raising the heel, and if there had not also been foot-drop, the boy would doubtless have walked on his heel with his toes in the air, as in pure paralytic calcaneus. As the entire distribution of the anterior tibial nerve, embracing the tibialis anticus, the extensor longus hallucis, and the extensor longus digitorum, was paralyzed, while the entire distribution of the musculocutaneous nerve was intact, the case seemed a suitable one in which to attempt to divert some of the nerve impulses from the latter into the anterior tibial nerve. It was determined at the same time to transplant

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\* On June 3, 1908, Dr. Ashhurst did arthrodesis of the ankle-joint and of the subastragalar joint in this patient.

the peroneus longus into the calcaneum, so as to overcome as much as possible the calcaneus, which was the most disabling deformity. On June 1, 1907, Dr. Ashhurst isolated the musculocutaneous nerve by dissecting through the peroneus longus muscle, just below the head of the fibula. After finding the musculocutaneous nerve on the surface of the fibula, the anterior tibial nerve was easily located just to its mesial side, before it had perforated the septum between the peroneus longus and the extensor longus digitorum. Two sutures of very fine silk, threaded in ophthalmic needles, were then passed through the sheath of the anterior tibial nerve, one on either side, and after this had been done, the nerve was divided with a tenotome above this point, just below its recurrent articular branch. Then a longitudinal slit was made with a tenotome in the musculocutaneous nerve, and by means of the sutures previously placed in the musculocutaneous nerve the latter was drawn into the slit in the anterior tibial nerve, and sutured to the sheath of the anterior tibial nerve. Two other sutures were placed above and below the first two, through the sheaths only, to act as guys, and relieve any possible tension on those first placed. The deep fascia was closed with interrupted silk sutures, and the skin with chromic gut sutures. Then the peroneus longus tendon was divided at the base of the fifth metatarsal bone, and transplanted into the periosteum at the insertion of the tendo Achillis. The time of the operation was 40 minutes. A plaster cast was applied, extending to the middle of the thigh. After six weeks a new cast, extending only to below the knee, was applied, and worn for several weeks longer. At no time was there any evidence of injury to the musculocutaneous nerve, into which the paralyzed nerve had been transplanted. Since August, 1907, the patient has been wearing his old brace. There has been absolutely no result from the nerve anastomosis, the muscles supplied by the anterior tibial nerve having no more power than before the operation. The transplanted peroneus longus muscle has restored a slight degree of power of raising the heel, and has at all events prevented a recurrence of the calcaneus deformity. Subastragalar arthrodesis will probably be required later, as the foot is still rather flail-like.

CASE 4.—*Paralytic valgus; transplantation of peroneus longus and brevis into base of first metatarsal bone.*

This case was reported at the last meeting of the Academy by Dr. G. G. Davis, in connection with his operation of transplantation of the tensor fasciæ femoris for outward rotation of the lower extremity from infantile palsy. The operations were done October 22, 1907. The transplanted peroneal muscles act well, and overcome almost entirely the previous valgus. An ordinary shoe is worn, and the slight limp is due chiefly to the shortness of the paralyzed leg.

CASE 5.—*Paralytic valgus; transplantation of peroneus brevis and extensor longus hallucis into base of first metatarsal bone.*

Pasquelino R., aged 7 years, had infantile palsy when four years old, and had never received any treatment for the resulting deformity. He entered Dr. Harte's service at the Orthopædic Hospital October, 1907, with marked valgus of the right foot. The tibialis anticus was paralyzed, but the extensor longus hallucis and extensor longus digitorum contracted well, and the peroneal muscles also appeared to be normal. The boy walked on the inner surface of his foot, with a very marked limp. On December 10, 1907, Dr. Ashhurst transplanted the peroneus brevis into the base of the first metatarsal bone, and as it did not appear to be as strong when seen at operation as it had been thought to be before, the tendon of the extensor longus hallucis was divided on the dorsum of the foot, and after suturing its distal end to the neighboring tendon of the extensor longus digitorum, its proximal end was also sutured into the base of the first metatarsal bone, at the point of insertion of the tibialis anticus, thus supplementing the paralyzed tibialis anticus by both the peroneus brevis and the extensor longus hallucis. The plaster cast was removed two months later. The transplanted muscles now contract satisfactorily, and while there is no over-correction, the valgus deformity has been overcome, and the arch of the foot restored. The patient wears a shoe with its sole raised on the inner side, and is able to walk very well without any kind of apparatus, and with a scarcely noticeable limp.

CASE 6.—*Paralytic valgus; transplantation of peroneus longus into base of first metatarsal bone, and transplantation of distal end of tibialis anticus into extensor communis digitorum.*

William M., entered Dr. Harte's service at the Orthopædic Hospital, May 4, 1905, at the age of 7 years. He had had

FIG. 1.



Case I. Position of transplanted tibialis anticus outlined on the skin.

FIG. 2.



Case II. Paralytic valgus before operation.

FIG. 3.



Case II. Paralytic valgus after operation.

FIG. 4.



Case III. Paralytic calcaneus with varus and foot-drop. Before operation.

FIG. 5.



Case III After operation. The incisions for the nerve-anastomosis and for the tendon transplantation have been outlined on the skin.

FIG. 6



Case V. Paralytic valgus. Before operation.

FIG 7.



Case V. After operation.

FIG. 8



Case VI. Paralytic valgus. Before operation.

FIG. 9.



Case VI. Paralytic valgus. After operation



infantile palsy at the age of 2 years, which had left him with valgus and slight ankle-drop of the right foot. The tibialis anticus, tibialis posticus, and extensor longus hallucis were paralyzed; the extensor longus digitorum contracted well, and the peroneal muscles appeared to be normal. A brace was ordered, but the patient did not return to the Orthopædic Hospital for nearly two years, when it was found that an operation of some kind (apparently shortening of the tibialis anticus) had been done by a homœopathic doctor. The boy was now wearing a brace, and his foot was if possible in a more deformed condition than at his first visit. Without the brace there was marked toe-drop, and he walked on the inner side of his foot, his sole turning outwards. He was admitted to the ward of the Orthopædic Hospital in October, 1907, and his foot was forcibly stretched under an anæsthetic on October 24, November 7, and November 30. The deformity having now been entirely overcome, Dr. Ashhurst operated December 31, 1907. The peroneus longus was transplanted into the base of the first metatarsal bone, and as it did not appear to be very strong, and as the extensor longus hallucis was entirely paralyzed, the tendon of the tibialis anticus was divided above the annular ligament, and its distal end was sutured under tension to the tendon of the extensor longus digitorum, which was normal, thus pulling the foot into the varus position. The plaster cast was removed two months later, and the result was found to be more satisfactory than had been anticipated: by flexion of the ankle through the extensor longus digitorum the distal end of the tibialis anticus is also pulled upon, so that the foot is no longer everted, but can be somewhat inverted also. The patient wears a shoe with its sole raised on the inner side, to maintain the over-corrected position.

DR. JOHN H. JOPSON discussed the result in the second case shown by Dr. Ashhurst, in which he transplanted the gracilis and semitendinosus into the upper border of the patella. The patient is greatly improved, there being additional strength given to the knee. But the lack of power of voluntary extension would seem to support the views of Lange, who advises that in transplanting the ham-string tendons the entire group be transplanted rather than a couple of muscles, as in this way there is a much

greater chance of achieving early alteration of function of the muscle from a flexor to an extensor.

DR. G. G. DAVIS referred to the question raised by Dr. Jopson as to the utility of transplanting certain parts of a group of muscles. Dr. Davis said that in practically all of the cases, even where there was a transplantation of but a single muscle, the result was satisfactory; that he has had cases in which the transplantation of the semitendinosus has been sufficient, and although it might not give the power of extension which would be derived from the transplantation of the entire group of flexor muscles, it was nevertheless sufficient to steady the knee, rendering it possible to dispense with the use of any apparatus. The main object of the operation is to give sufficient power of extension to prevent the knee from suddenly flexing as the patient walks and he believes that this result can be obtained in some cases by the transplantation of a single muscle.

DR. JOHN H. JOPSON said that he had not meant to criticise the operation which had been done in the case discussed, as the result was an excellent one, but thought the case referred to was a good example of the contention raised by Lange. When tendon transplantation was first brought forward it was claimed that one could alter at will the function of the muscle as easily as we could change its insertion. This claim has been found somewhat exaggerated, and as a result there had been for a time a revulsion of feeling in regard to the operation.

DR. WILLIAM L. RODMAN said that three weeks ago he had anastomosed the musculospiral for wrist-drop, doing practically the same operation as Dr. Ashhurst, bringing the distal end of the nerve over to the median, by transfixing the brachialis anticus muscle and anastomosing it with the median and musculocutaneous. At the present time there seems already return of sensation in the skin over the hand and fingers.

DR. ASHHURST, in closing, said, in reply to inquiry, that he did not know how long one should expect to wait for a nerve to regenerate; ten months had elapsed in the present case. He said that he had seen statements that even one or two years should be allowed to elapse before hope of a good result should be abandoned; and said that if in that length of time his patient should be fortunate enough to obtain return of power, he would take pleasure in showing the boy again.

## TWENTY-FIVE HUNDRED CASES OF GAS-ETHER ANÆSTHESIA WITHOUT COMPLICATION.

DR. J. J. A. VAN KAAATHOVEN (by invitation) read a paper with the above title, for which see page 435.

DR. JOHN B. ROBERTS thought the reader had brought out a point not always insisted upon, namely, that very little ether is needed after the patient once becomes etherized. Dr. Roberts said that it would seem from his experience with the Resident Physicians who administer ether for him that they had never been taught the importance of this fact. They get the patient etherized for the surgeon and then continue to pour on as much ether as they did at the start. He thinks Dr. Van Kaathoven has properly emphasized the need of plenty of ether to start with but very little afterwards, and the desirability of having the patient in such condition that he comes out of ether as soon as the operation is over. He is inclined to believe that what is called the "drop method" has been so talked of recently that many men are claiming to give ether by what they call the "drop method" when they are really pouring more ether on the inhaling apparatus than is done by those who know what is scientific administration of the anæsthetic. After all, it is not the "method" that is to give safety to the patient, but the experience and brains and attention of the administrator.

DR. G. G. ROSS said that there were two things about serious operations which gave him an undue amount of alarm. The first is the junior resident who gives the ether and the other is the unsophisticated female who handles the gauze. He thinks that the danger does not lie so much in the ether as in the man who is giving it. In hospitals where they do not have teaching in connection with the other hospital work and therefore no teacher for that particular art, he thinks it would be wise to have an official anæsthetizer on the senior staff who would be responsible for the instruction of students or residents until they are fully qualified to give ether properly and safely.

DR. G. G. DAVIS said that the use of nitrous oxide preceding ether anæsthesia is an old one although it seems to be coming into favor only now in this progressive country; it was commonly used in London over twenty-five years ago, and he thinks a method which has taken so long to establish itself on an acceptable basis argues either that the public is very slow in recognizing

the utility of good things or else it is not worthy of recognition. The objections to the method are in the first place, that it requires more experienced anæsthetizers and it gives rise to very considerably more mucus, and the transition from nitrous oxide to ether is liable to be unsatisfactory, especially, Dr. Davis believes, when the so-called "drop method" is used. We hear of eight to sixteen layers of gauze but personally Dr. Davis has never liked gauze, thinking it inferior to a close meshed towel in efficiency. Time and time again he has had the anæsthetizer fail to anæsthetize the patient rapidly, simply on account of the amount of air which is inhaled. He believes in deliberately excluding air when it is desired to rapidly anæsthetize the patient.

As regards the advantages of nitrous oxide, Dr. Davis was not prepared to admit with Dr. Van Kaathoven, that it leaves the patient in better shape than a simple anæsthesia with ether. If ether is used alone and time is taken in its administration, he believes it is the safest anæsthetic agent, and if it is preceded by the morphia and atropine injections its results would be as good, as far as the after-effects go, as if preceded by nitrous oxide.

DR. WILLIAM L. RODMAN said that he thought it had long ago been conceded that ether is best preceded by nitrous oxide. He also believes that chloroform can be preceded by nitrous oxide in the majority of instances. He was particularly glad to hear that one hundred students at the University had been allowed to administer the anæsthetic. He does not think it a broad position to say that a paid anæsthetist should be in every hospital; certainly not in teaching hospitals, for if the students are to be sent out without practical experience, how can they be expected to give an anæsthetic. Dr. Rodman thinks that it is perfectly safe for students to give ether under competent instructors inasmuch as the danger signals are thrown out promptly and are easily recognized and met. During the past term every senior student at both the Woman's Medical College and the Medico-Chirurgical College has given an anæsthetic. He thinks that the giving of anæsthetics is one of the most important things to be taught students. Dr. Rodman agrees with Dr. Van Kaathoven that the drop method is the best. Also that if ether is not to be preceded by gas a most valuable adjuvant is talking to the patient, for he has literally seen patients almost talked to sleep. He is impressed with the fact that ether is not as safe

an anæsthetic as is generally thought; there is a great deal of pneumonia following it. He does not consider it safer than chloroform. He has given chloroform as often if not more frequently than ether and has never seen a death from it in his own practice, but he has had three deaths from ether. When a patient goes off the table after chloroform one can be easy about him, whereas it is the reverse with ether; they are apt to have suppression of urine, develop pneumonia or bronchitis. For these reasons Dr. Rodman prefers giving chloroform in nephritis rather than ether. He thinks that in hospitals where it is practicable, ether should always be preceded by nitrous oxide, as he believes this will reduce the mortality rate from the administration of ether very materially.

DR. CHARLES H. FRAZIER does not believe surgeons connected with non-teaching hospitals realize how much they are handicapped in educational institutions where a greater part of the routine surgical work is carried on with students as etherizers and assistants. It is not fair to criticise a junior resident at the hospital because he is not at the time he enters upon his work a skilled anæsthetist. The fault lies with the organization of the clinic and the administrative officers of the hospital. To assign to a junior resident the responsible post of anæsthetizer is a practice worthy only of condemnation and fortunately long since abandoned by many hospitals.

DR. OSCAR H. ALLIS said that the discussion on this subject had helped him to understand why it was so hard to teach the young men who came to the Presbyterian Hospital the way in which to administer an anæsthetic, as they had administered it two or three times somewhere else and thought they knew it all. It seemed to make no difference to them that Dr. Allis had had thirty-five or forty years of experience. Dr. Allis said that operators often become impatient and hurry the anæsthetizer; for his part he never hurried the anæsthetizer, and always considered his duty as important as was his own as operator. He has sometimes seen the patient almost dead from an overdose of ether, and the anæsthetizer still pouring it on, wholly oblivious to the patient's critical condition. He thinks that anæsthetizers are as a general rule too much interested in the work of the surgeon and not enough interested in their own important duties.

Dr. Allis said that any one who knew anything about ether felt that he knew nothing, as the dangers and responsibilities change with each individual case. He thinks it would be a wise arrangement if each hospital had a well paid expert anæsthetizer.

DR. JOHN H. GIBBON emphasized one improvement which has been made in general anæsthesia, namely, reduction in the amount of ether which is given. Where gas or ethyl chloride is given first, and especially where these agents have been preceded by morphia and atropine, the patient can be fully anæsthetized in from three to four minutes. The morphia and atropine given twenty minutes or half an hour before the anæsthetic is started reduces the amount of ether necessary during the progress of the operation. By following out this plan the ether given the patient is reduced to the minimum, and the after-complications which result from ether are greatly reduced. Dr. Gibbon wished to know in what number of the 100 cases which Dr. Van Kaathoven stated had been anæsthetized by students, and in 81 per cent. of which no subsequent nausea or vomiting had occurred, morphia and atropine had been given prior to the anæsthetic.

DR. VAN KAATHOVEN, in replying to Dr. Gibbon's question as to the number of patients who had morphia and atropine given beforehand in the series of 100 anæsthetized by students, said that he did not think over 20 per cent. received this preliminary treatment, and that in at least fifty private cases there was the same percentage. He does not think the morphia renders the patient more prone to nausea. After the patient becomes conscious from the anæsthetic he often passes off into a comfortable sleep.

With reference to Dr. Allis' remarks, Dr. Van Kaathoven said that he realized the difficulty of impressing the student with the fact that just because he has a bottle in his hand there is no reason why he should always be pouring from it, and that it is only by keeping them to the other extreme that he is able to impress upon them the importance of not anæsthetizing too deeply. One never knows what is going to happen and it is therefore of the utmost importance to pay strict attention to the patient at all times.









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